

# **73 Amateur Radio Today**

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International Edition

## **Meteor Scatter**

**Bounce Your Signal Off a Star!**

**Standardize Your Microphones**

**Build a Portable 2m Quad**

**Computerize Your CW**

**73 Reviews**

**Kenwood TH-28A HT**

**XPERTEK Digital**

**Voice Mail**



# ICOM's IC-2GXAT . . . Powerful Versatility In A Rugged, User-Friendly Handheld.

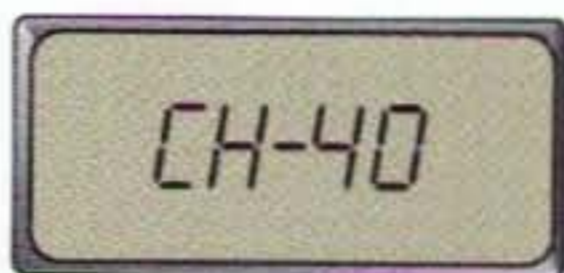
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**DTMF Redial** – for quick and easy access to autopatches.

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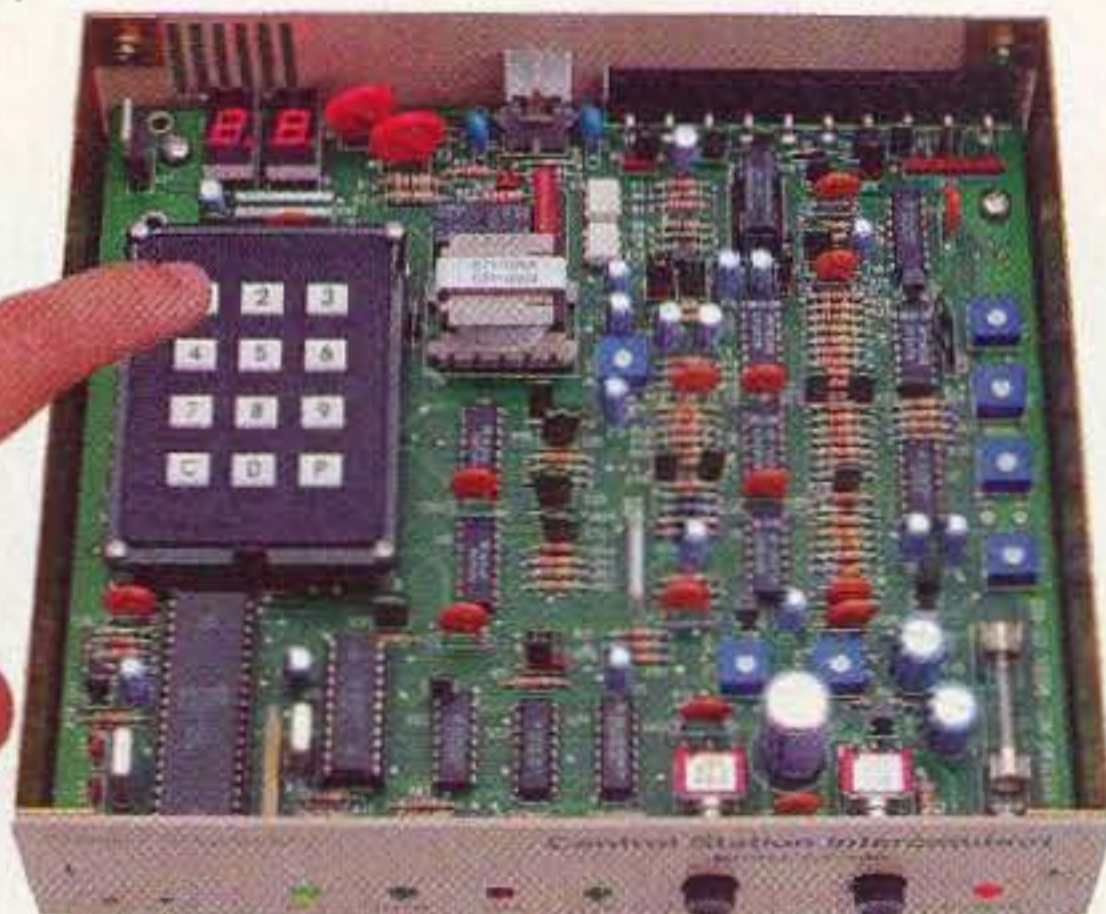
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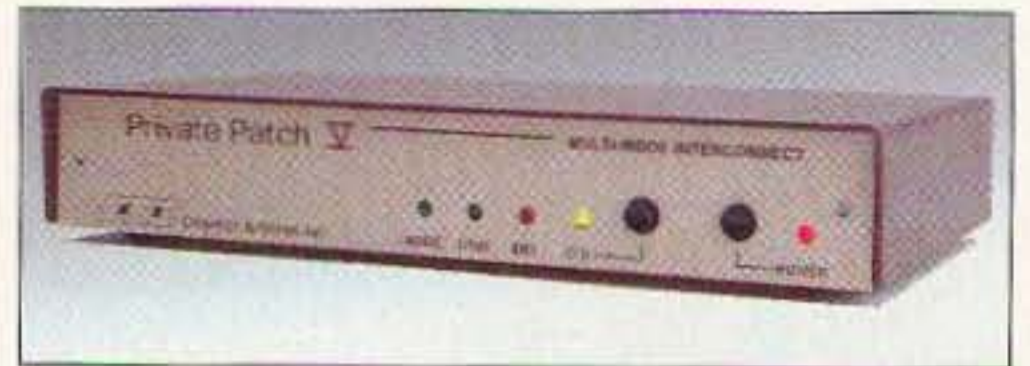
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On the cover: Bounce your signal off a shooting star! Learn all about VHF meteor scatter propagation . . . see page 10. Star photo courtesy of the National Optical Astronomy Observatories. Antenna photo courtesy of Rutland Arrays.

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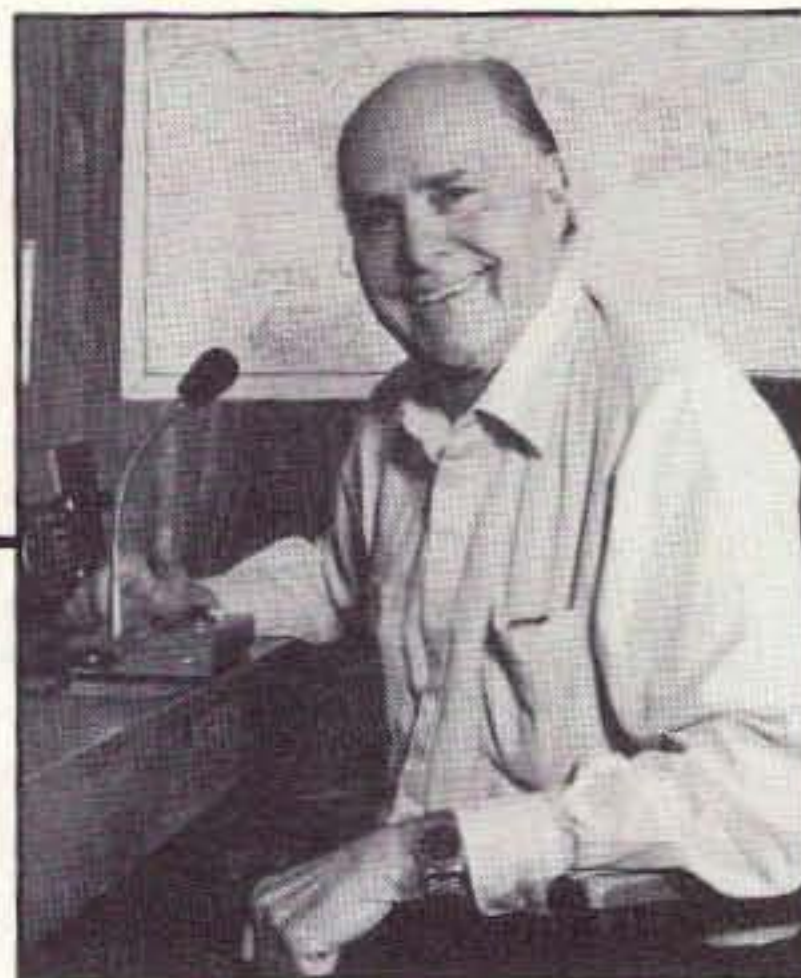
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# NEVER SAY DIE

Wayne Green W2NSD/1



## Uncle Wayne's Caribbean Adventures

The downside of the laptop computer is how easy it makes it for people to write. People like me, for instance. Naturally I had my little Mac PowerBook with me when I made my 11-island 21-day Caribbean ham-music-diving 71st birthday celebration safari in September. In between mini-hamfests, scuba diving, flying from island to island, and reading a pile of books I'd brought along, I somehow managed to write a blow-by-blow travelogue of the adventure.

Any seasoned reader of my editorials will not be surprised that it quickly assumed epic proportions. It started as a simple letter to my Aunt Kitty in Joliet, but it grew legs. By the time I got the whole thing together it ran a *Reader's Digest*-sized 40 pages. Then I added a story from my 1992 visit to Dominica, where I almost got skewered by a thrashing diving ladder. Say, why not include a hilarious story I did about my diving cruise on the Ocean Quest a couple years back? And a couple other Caribbean diving vacations?

I somehow couldn't help myself from sending a letter to the dive operators on the islands I'd visited, telling them how to improve their product. I added that to the saga. And being into economic development here in New Hampshire, I saw lots of opportunities for the island leaders to attract more tourists and develop industries to pull their countries out of poverty. And most of them are deeply embedded in poverty. I added that to the saga too. I'll send the letters to the leaders, knowing they probably won't bother to read them.

Though these were mainly scuba diving trips, and thus you, as a mono-interest person, totally dedicated to lousing up what shreds we have left of what was once a glorious hobby, probably could care less about the adventures of frugal septuagenarian Uncle Wayne. Worse, the writing, according to my critics, is vintage Green. Pity. Well, anyone who reads this pile will certainly know Uncle Wayne better. Maybe I should start billing myself as Grandpa Wayne. Gramps. Grumpy Gramps. Gimpy, grumpy Gramps, honoring my gimpy left knee.

When I get finished with the saga it'll

probably run 80-100 pages. It'll cost something to print, so I can't just give it away free. How about \$5? Postpaid? For \$10 I could include pictures, but finding a ham with a spare \$10 bill is so unlikely that I didn't even consider that. Maybe, instead of buying popcorn and a drink at the movies next time, you could spring for my *Adventures*? It's amusing stuff.

But then you haven't bothered to send for my work of sheer (thin) genius, *We the People Declare War On Our Lousy Government*, wherein I present you with the keys to solving most of our more serious social, economic, political, and ecological problems. Oh, a few readers have read it and I appreciate their enthusiastic letters. I'll feel even better if I see some of them deciding to actually do something about cleaning up Congress, cutting crime, and improving our miserable school system. Politically I'm not ultra-right or ultra-left—maybe I'm ultra-center. No, I'm pragmatic, wherever that fits.

My enemies will love my *Adventures*. So will my friends—both of them. Everyone else will, as usual, sigh, turn the page and forget all about it. Of course, if I can get you hooked, I might be able to foist off the 20 issues of my *Declare War Update* reports. These beauts run 16 pages each. One of these days I'll edit 'em, toning down some of my perhaps too clearly expressed frustration with the political baloney here in New Hampshire, and print the reports as another book. There's a ton of good ideas in 'em. Check Uncle Wayne's Bookshelf and see if we've managed to list this stuff there. Then send money. Or call our 800 number.

### OK, You Electronic Experts

I've just heard from a second 73 reader who says, "I don't care what some loony researcher has shown, I know that all this stuff about 60 Hz magnetic fields hurting people is bunk." I asked both if they'd read anything about the research. They hadn't, because they knew it was baloney, so why waste their time?

This reaction is one scientists should appreciate, because this same approach is endemic in the scientific community. It's dandy retribution when it happens to them. In the science busi-

ness the deck is stacked against research in any new field. A scientist's success is measured by the number of papers published. The more papers, the easier it is to get research grants. But the scientific journals are reluctant to publish papers which challenge orthodoxy, thus making sure that research projects are not challenging. The result is that today science has lost its spirit of adventure.

In the past scientists have held on to their beliefs tenaciously, and only reluctantly accepted new ideas when there was no other refuge. Let me quote Max Planck, the pioneer in quantum physics: "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it."

Quantum physics really shook up the scientific world. It answered some questions, but in the process it opened up many more that scientists are still struggling with. It's fun to read about all this. I've read several fascinating books recently on this subject. I really should review them for you and see if I can get you to read them. There's *The Holographic Universe* by Michael Talbot, and *Parallel Universes* by Fred Wolf.

As usual, I digress. Well, there are so many interesting things to talk and write about that my talks and writing seem to mainly be a long series of digressions. Perhaps my recognizing this has contributed to my cutting way back on the number of talks I've been giving at hamfests and conventions. About the only hamfest where I've been speaking lately is at Dayton. I've been thinking of stopping that too. There are just too many exciting things to talk about and too little time.

### Electromedicine

Now, undigressing, and getting back to bioelectromagnetics and bioelectricity, I read a book while on my birthday Caribbean tour that I just have to tell you about. It's *Cross Currents* by Robert Becker. The subtitle is: "The perils of electropollution and the promise of electromedicine—a startling look at the effects of electromagnetic radiation on your health." This book really kept my highlighter busy. It was exciting to read.

Not only will the research that has been done in this field fascinate you, it may well get you to thinking about setting up a little lab and investigating some areas where there's still a need for basic research—research which is within your ability to do.

The more you read about life and the cells which make up life, the better you understand that life can be seen as fields within fields within fields. And this is helping to bring about a revolution in medicine. We know now that chemicals and surgery aren't the only possible ways of curing illnesses. We know that the mind can influence the body, and that the body has a powerful innate self-healing system. So we're seeing a growing interest in "unscientific" approaches such as acupuncture, placebos, visualization, homeopathy, hypnosis, healing, foods, herbs, meditation, and electromedicine. Are there more productive approaches to tackling illnesses such as diabetes, AIDS, chronic-fatigue syndrome, Alzheimer's, autism, and even cancer? Is it possible that a physicist who is an ex-ham really has a little simple-to-make electrical gadget that can cure AIDS? I'll tell you more about that further on in this editorial. He also has an electronic gadget that stops drug addiction in its tracks.

Now, back to Becker's book. He starts out with the history of medicine, explaining how it has evolved. You're probably familiar with the story of how Lister discovered germs, how physicians refused to believe him, and continued to kill most of their surgery patients through infection for many more years. Becker didn't mention that, but it makes a good point.

Scientists have found that our bodies work on an incredibly complex combination of both chemical and electric actions. So Becker got interested in how salamanders are able to regenerate arms, legs, and tails. Maybe, if we understand how they do it, we might be able to regrow human arms and legs. He discovered that very minute electrical currents controlled the regrowth phenomenon. Minute being billionths of an ampere!

You'll read about how he applied his new understanding to the regrowth of leg parts in rats, and in helping speed bone fracture healing. You're not going to like this, but researchers have found an amazing correlation between the voltage points on the body and the acupuncture points of ancient Chinese medicine.

Becker traces the history of cancer research and the changing medical beliefs about it. The newest research indicates there is an electronic biological control system involved. This would help explain spontaneous remissions, the placebo effect, and so on.

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Continued on page 85

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# LETTERS

Number 2 on your Feedback card

## From the Hamshack

**Randy Crase KB7UIT, Woodland WA** Wayne, I just finished writing out my check to renew my 73 subscription, and also reading your editorial in the September '93 issue. Great job, Wayne. Actually, I have read many of your editorials in the two years I've been licensed. One theme stays constant: I fully support your views on the ARRL and do not belong to the organization or subscribe to *QST*. In your last editorial you again brought up the fiasco of CW. You also stated that the ham population should circumvent the ARRL in proposed new rule changes to the FCC. How does one go about proposing rule changes?

I am a No-Code Tech and, like many, do not care to spend the time learning code at 13 wpm to get a General Class license. Supposedly, by ITU convention all HF privileges are to be allowed upon passing a test for CW. However, there is no requirement about speed. What I would like to see is a 5 wpm requirement for all license classes, or elimination of CW as a requirement. I know that the "live and die by CW" group will throw fits and keys at this proposal; that's OK. The majority of hams now are No-Code Techs, and the number is increasing. Most of these people are not "glorified appliance operators." I have talked to many very intelligent No-Code Techs—doctors, engineers, programmers, etc. These people could pass just about any theory test you could toss them, yet they are still No-Code Techs. They do not upgrade because they don't want to "waste the time" on an "ancient form of communication." I have absolutely no problem with requiring a theory test for various classes of licenses.

If No-Code Techs are "glorified CBers" then more power to us. All I need do is turn on my VHF equipment and listen to very little garbage, or turn on HF to 14.313 or 40 meters and listen to some of our "superiors" trash the band.

Wayne, keep on pushing the ARRL. It's now time to get rid of the code requirement, or at least make it so easy that it's just a nuisance.

*Well, gee, I dunno . . . Wayne*

**George M. Badger III, San Jose CA** Wayne, you certainly are an EE (Eclectic Editoralist) if I ever saw one. And at my age I have seen more than four. Your October '93 editorial brought up a very good point: The majority of nam QSOs are very boring and very often pedantic. It seems that quite a few of the hams on the air are old, unhappy and definitely right-of-center. Getting older has its rewards, one of which is that we all have a larger cross

section of experiences to draw upon and therefore we should have more to talk about. Nope, it doesn't seem to work that way. I don't know why people are not excited about their lives and want to learn more about others' lives and therefore enrich their own. From my small outpost in the world, the loudest complainers are generally a small minority who are "control freaks" afraid of CHANGE! They go out and spend for *large signals* so they can attempt to prevent others from having their own experiences. They are often accompanied by labels so they will be able to identify their own "tribe." Or is it diatribe?

Wayne, you are correct. Life is not a spectator sport. If you are not part of the solution, you are definitely part of the problem. Anybody can sit back and point out how something may not work, but it takes a real person to stand up, join in and make things happen. Hey, tell them this: "If you don't like the news, go out and make your own."

Thank you for the features on QRP. I am in the process of co-writing a book on QRP and equipment modifications that should be out mid-1994. I'm an ex-ham who has missed hamming and am in the process of retrieving my ticket. Solar QRP DX is my bag.

*Good grief, another troublemaker . . . Wayne*

**Ed Eggert W3HIK, Fair Haven NJ** Just a quick note to let you know how pleased I am with the Packet Mac modem out of your October 1992 issue. Dexter Francis of Sigma Associates is a delight to do business with. He was kind enough to answer all my questions about the modem before I ordered one.

I had purchased a commercial TNC to use with my Mac and after three months of faxing back and forth I still could not get it work. Try as they could, they admitted that they did not have a Mac to test it with.

The Packet Mac, along with Savant software, worked without a hitch. If you have a Mac, it's the only way to go. Now, if we can convince Dexter to design a regular modem with fax for the Mac we will have it made.

Thanks for running the article.

**Harry M. Johnson NV7K, Kalispell MT** I just finished reading the December 1993 "Never Say Die" and I feel I must write to you. I've recently purchased some new items that I feel motivated to report on as per your request. I generally use boat-anchor-type equipment that I acquire and then restore to working condition,

but occasionally I feel the time is right to purchase some type of new gear.

I would like to review a new book I have purchased (new to me, that is): *Solid State Design for the Radio Amateur* by Hayward W7ZOI and DeMaw W1FB. It is published by the ARRL and the price is \$12. I have an academic background in the biological sciences and education and have a solid foundation in physics and math, but I need references when I want to build certain types of circuits. While building an oscillator, filter, etc., it is very nice to be able to look up a circuit and quickly determine component values without having to do it by trial and error. I have sought out this type of reference work on many occasions and have really never found one to do the job, until this one. Some representative chapter headings are: "Semiconductors and the Amateur," "Basics of Transmitter Design," "Power Amplifiers and Matching Networks," "Receiver Design Basics," and "Test Equipment and Accessories."

I live in a rather isolated area with respect to retail amateur radio dealers. I can order by phone or fax or USPS, but sometimes you just can't beat hands-on shopping. A few weeks ago, while visiting my uncle, W7GBI, and his family, we had occasion to visit one of the Ham Radio Outlet retail stores. While browsing over the book shelves, I spotted Hayward and DeMaw's book and knew then and there that it was what I was looking for. I know it is not a new title, but I had not seen it before and it really meets a need for me.

Another new item I would like to share is an ICOM IC-2iA 2 meter handie-talkie. We were looking for a very small, uncomplicated HT. While at the same HRO store, we looked at and got the feel of all the mini HTs. The IC-2iA is definitely the smallest and has the fewest external controls. The neat part is that by using the few controls on the outside in various combinations and permutations one can program onto the CPU all of the operating parameters used by your average 2 meter repeater user. Clock setting, power on and off times, CTCSS tones, DTMF autodialing, paging, and power levels can be preprogrammed in and then actuated with a few well-chosen keystrokes (two or three in all cases). The radio has two levels of programming: the basic for everyday functions used most often, and an advanced mode with the more complex levels of operation available. There is even an AI mode in which the HT learns which functions you use most often and expands the programming to suit what it perceives as your needs.

Wayne, no doubt about it, you are a windbag, but I guess I, and your other faithful readers, wouldn't have it any other way. I do find 73 to be the most interesting of the "Big 3" not only because of your editorials but also because of the general content and the

types of articles and regular columns that you include. Thanks for a good job and I won't worry about you becoming complacent and resting on your laurels because of too much praise.

*Me a windbag? Harrumph . . . Wayne*

**Tom Tobiassen NØBZ, Aurora CO** Wayne, in response to your December 1993 editorial, I would like to give you my rating of a ham product.

I would rate my Kenwood TS-50S HF transceiver as a "9." I purchased this radio last spring and I've been very happy with it. I have always been interested in operating HF from the car while traveling and I've dreamed of operating HF while on vacation. This radio has given me the opportunity to do both this past summer. While on vacation at Grand Teton National Park, Wyoming, in July, I operated 20, 15 and 10 meter SSB while in the car chatting with folks all over the U.S. I operated 40 and 15 meter CW from the rented cabin using a dipole, chatting with other hams all around the world. I really enjoy this radio.

**Ed Maikranz KG5UN, Abilene TX** Wayne, greetings from West Texas. I work as a firefighter-EMT here. I have been a ham since 1988. I also spent eight years in the army as an HF RTTY operator.

I want to tell you about the two latest additions to my shack. The first was an ICOM IC-729 HF and 6 meter rig. This is a nice, compact, easy-to-use radio; not too complicated. It has simple controls and comes with good instructions. I have been using it for a little over a year and am very pleased. It works great in all modes. Shortwave listening in AM sounds very nice. The noise blanker and preamp are both very effective. It handles RTTY, AMTOR, PACTOR and packet with no problem. The radio works like a champ on 6 meters also. It's a good receiver for weak signals, and does a fine job with FM simplex and repeaters as well. All it needs is transverter connections on it.

A few weeks ago I picked up an MFJ 1278B multimode data controller. This is a very versatile unit. On packet it works great, and has a nice built-in mailbox. RTTY, CW and AMTOR are easy to use and do very well. PACTOR is a nice mode and this unit supports it very well. I have copied color slow-scan pictures with good results and also copied a lot of fax pictures with very good results. This was a good value for my money.

My radio interests are quite varied. I like chewing the rag on HF, mainly on 17 meters. I enjoy all of the HF digital modes as well. I also enjoy weak-signal VHF work, currently on 2 and 6 meters. I have done a lot of meteor scatter work as well, and have made contacts on the RS satellites. I hope to get on the OSCAR birds soon, as well as doing UHF weak signal work. 73



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Low noise converters to receive vhf and uhf bands on a 10M receiver.

- Kit less case \$49, kit w/case & BNC jacks \$74, w&t in case \$99.

• Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (to chan 3).

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As a voice ID'er for repeaters, records your voice, using the built-in microphone or external mic. Use with almost any repeater COR module. May also be used as a contest caller to play back one or more messages through your transmitter at the press of a switch. Used as a radio notepad, it can record the audio output of a receiver — up to 20 sec. of anything you might want to recall later. Play back as many times as you like through a small external speaker. Extensive manual tells how to use multiple messages and adapt for many applications.



.....kit \$59, w&t \$99

### TD-4 SELECTIVE CALLING Mod- ule

Versatile dtmf controller with 1 latching output. Mutes speaker until someone calls by sending your 4-digit tt code. Or use it with a long tt zero digit to alert anyone in club. Also may be used to control autopatch or other device. ....kit \$49, w&t \$79

### COR-3 REPEATER CONTROLLER

Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier. ....kit \$39

### CWID

Diode programmable any time in the field, adjustable tone, speed, and timer. ....kit \$59



**COR-4.** Complete COR and CWID all on one board. CMOS logic for low power consumption. EPROM programmed; specify call. ....kit \$79, w&t \$129

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**TD-2 DTMF DECODER/CON-  
TROLLER.** 16 digits, toll-call restrict-  
or, programmable. Can turn 5 functions  
on/off. ....kit \$79, wired & tested \$139

**AP-3 AUTOPATCH.** Use with above  
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and phone line remote control are std.  
.....kit \$79, wired & tested \$139

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Board. Use with above for simplex  
operation using a transceiver .... kit \$39

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CODER/ENCODER.** Adjustable for  
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with remote control activate/deactivate  
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DE-202 FSK DEMODULATOR.** Run up  
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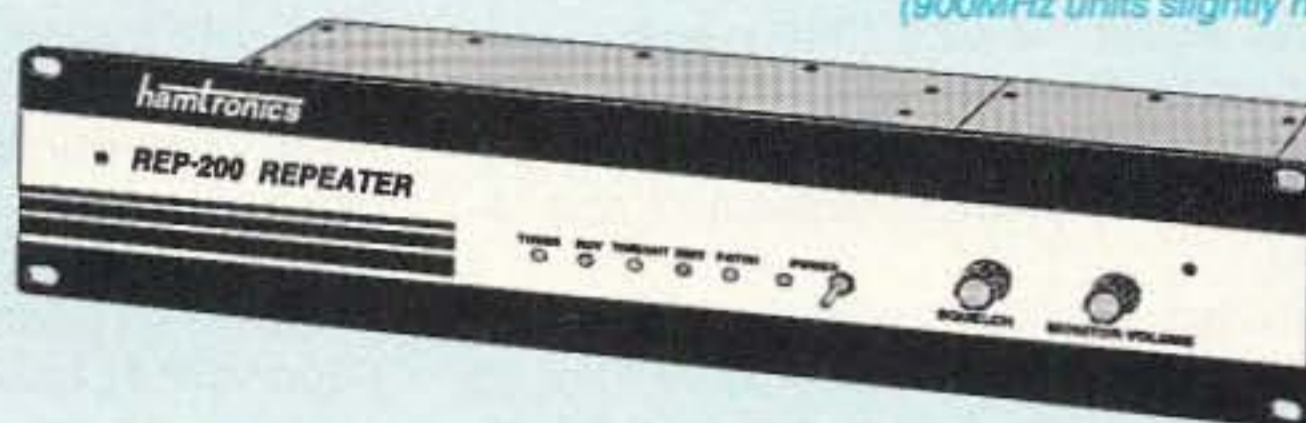
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Low-cost packet networking system,  
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Transmitters and Receivers. Interface  
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# REP-200 REPEATER

A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

We don't skimp on rf modules, either! Check the features on R144 Receiver below, for instance: GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

Kit \$1095; w&t only \$1295!  
(900MHz units slightly higher)



- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- FCC type accepted for commercial service (150 & 450).
- Power out 20W 50-54MHz; 25W 143-174MHz; 15W 213-233 MHz; 10W uhf; 10W 902-928MHz.
- Available add-on PA's up to 100W.
- Six courtesy beep types, including two pleasant multi-tone bursts.
- Open or closed access autopatch, toll-call restrict, auto-disconnect.
- Reverse Autopatch, two types.
- DTMF CONTROL: over 45 functions can be controlled by 4-digit dtmf command, via radio or telephone.

- Owner can inhibit autopatch or repeater, enable either open or closed access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr.
- Cw speed and tone, beep delay, tail timer, and courtesy beep type can be changed at any time by owner password protected dtmf commands.
- Auxiliary receiver input for control or cross linking repeaters.
- Color coded LED's indicate status of all major functions.
- 3 1/2 inch aluminum rack panel, finished in eggshell white and black.

**NEW** REP-200T Voice Message Repeater. As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be remotely recorded off the air and played back at user request by DTMF command, or as a periodical voice id, or both. .... kit \$1145, w&t only \$1395

**NEW** REP-200C Economy Repeater. Like REP-200, except uses COR-6 Controller (no DTMF control or autopatch). Features real-voice id recorded with built-in microphone. .... Kit only \$795, w&t \$1095

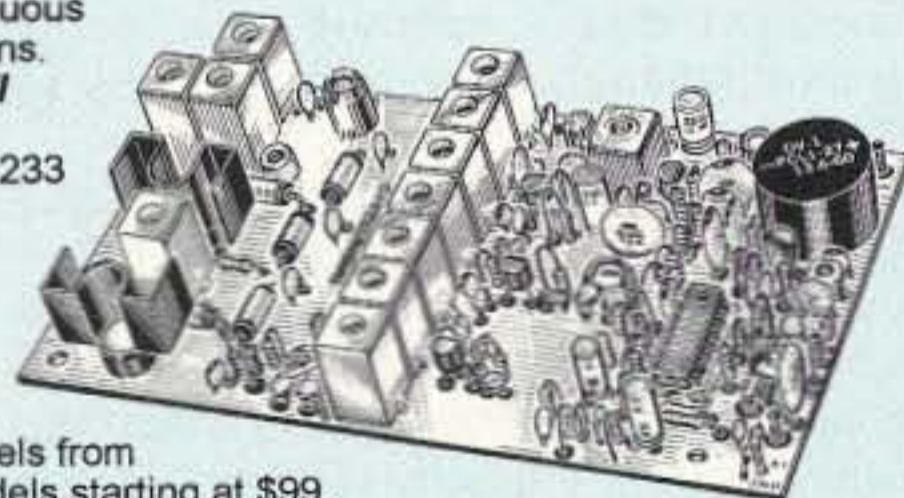
REP-200N Repeater. Want to use your ACC controller, etc.? No problem! We'll make you a repeater with rf modules only. .... Kit only \$695, w&t \$995

## XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-flight enclosures, and with data modems.

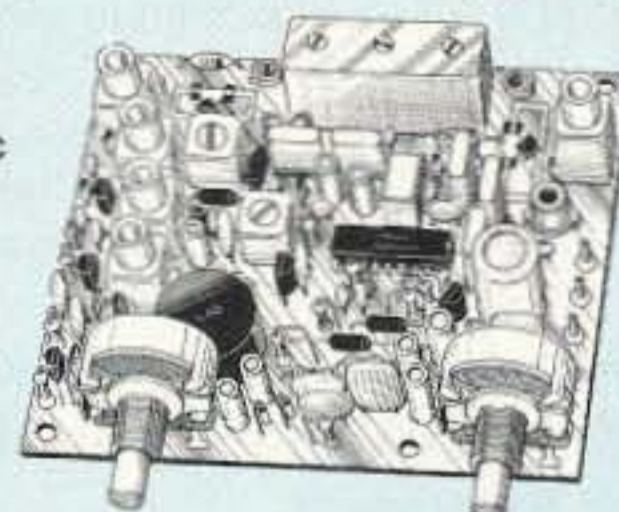
**FM EXCITERS:** 2W continuous duty. TCXO & xtal oven options. FCC type accepted for com'l high band & uhf.

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- R451 FM RCVR, for 420-475 MHz. Similar to above. ....kit \$149, w&t \$219.
- R901 FM RCVR, for 902-928MHz. Triple-conversion, GaAs FET front end. ....\$169, w&t \$249.
- R76 ECONOMY FM RCVR for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res or afc. ....Kits \$129, w&t \$219.
- R137 WEATHER SATELLITE RCVR for 137 MHz. Kit \$129, w&t \$219.



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## Radio Operators Behind Bars

Three young residents of the California Youth Authority's Camp Fenner recently received their amateur radio licenses after a long period of study. The idea was formulated by Parole Agent Bill Goff KI6DJ, with assistance from Teacher Ed Griffith KC6WCT. All three wards were first carefully screened for the proper levels of ability, motivation, and rehabilitation.

Organizers say ham radio teaches discipline, cooperation, and geography—not to mention electronics. For some youthful offenders, this is their first experience being cooperative or successful. The program is believed to be the first of its kind. Anyone with experience using amateur radio to rehabilitate young men should contact Ed Griffith KC6WCT, P.O. Box 30275, Stockton, CA 95213-0275; (209) 825-9458. *TNX KC6WCT.*

## Wanted: Young Hams

Once again, Carole Perry WB2MGP is looking for articulate, active amateur radio youngsters up to age 18 to be interviewed for possible participation in the Dayton 1994 Youth Forum. This year's forum will be bigger and better than ever. Please contact Carole at P.O. Box 131646, Staten Island, NY 10313-0006, or telephone her at (718) 983-1416. *TNX WB2MGP.*

## Huge Cable

A private venture with financial backing in the United States, Japan, and the Middle East, is planning to construct the world's longest under-sea fiber-optic cable, linking Europe, the Middle East, and Asia through 13 landing points. The new cable will join existing undersea links to open up broad bandwidth international multimedia services by 1996.

The Fiberoptic Link Around the Globe (FLAG) will cover 18,000 miles, from Britain through the Mediterranean Sea and Indian Ocean to Japan. FLAG is expected to complete the first global high-capacity fiber-optic highway of great capacity. The link would support 600,000 conversations simultaneously and support teleconferencing and entertainment video too. The huge cable would likely compete with satellites for business. *TNX Electronic Engineering Times, December 6, 1993.*

## Semiconductors: A Girl's Best Friend?

With financial backing from the White House, Russian and American scientists are beginning collaborations to develop new semiconductor technologies based on diamond films. The Clinton Administration has allocated funding to support the work of 20 Russian scientists for a year.

Russian diamond technology first came to light in 1977. Reports were largely ignored in the U.S. but were pursued in Japan. Now the University of Missouri has established the International Diamond Research Institute where researchers will work with the Laboratory of Diamond Film Crystallization at the Institute of Physical Chemistry in Moscow.

A primary goal of the new institute is to develop reproducible n-type and p-type diamond films that are more rugged than silicon for a new generation of semiconductor devices. *TNX Electronic Engineering Times, December 6, 1993.*

## Boyer Wants His HT Back

According to newspaper accounts, Chris Boyer KC6UQG, who accessed a sheriff's department radio frequency to summon medical help for an injured friend, now wants his portable radio back. Reportedly, Boyer first tried to get help via amateur radio, business band, and cellular phone, but to no avail.

Boyer contends that he made a responsible decision to use the Sheriff's frequency only after exhausting all other communications options. His friend had been hurt in a mountain bike accident and was bleeding. Two weeks after the incident, Boyer was called into a meeting with FCC and sheriff's department officials, where he surrendered his radio. It is not clear whether the radio was actually confiscated, or if it was volunteered in lieu of prosecution. *TNX Westlink Report, No. 662, November 26, 1993; W5YI Report, Issue #23, December 1, 1993; The San Diego Union Tribune.*

## Form 610 is New

A totally new FCC Form 610 is on its way into ham radio as a result of a new computer at the Federal Communications Commission. The venerable old 610 will soon fade into history as a result.

The new form is streamlined. It does away with all of the boxes previously contained in the administering VE's report. The report itself has been relocated to the bottom front of the form, right above the VE certification area. The administering VE will now only need to indicate which one of six classes the applicant is qualified for. The sixth category is "Technician Plus" and its inclusion on the new form indicates the commission wants to carefully track the popularity of this category.

Sections to report current station location and change of station have been eliminated. The new 610 still has a Physician's Certificate of Disability for those exempt from the code tests due to physical disability. This new form replaces the March 1992 version which carries a February 1995 expiration date, but which can no longer be used once the new form is in the hands of the public. *TNX Westlink Report, No. 662, November 26, 1993; Newline; W5YI-VEC.*

## Hams Cool Under Fire

Hams did more than just talk at the scene of the recent wildfires in Southern California. They put their lives on the line staffing the DCS22 Mobile Communications Van at Pepperdine University at the height of the fire threat. Hams also handled the fire hoses as flames assaulted the Malibu Sheriff's Station.

After 108 hours of continuous operation, Scott KD6NEA closed down the emergency operation by saying: "The cooperation of all amateurs in clearing the frequency for this net has been greatly appreciated. The frequency is now clear at 1800 hours." FB to all who pitched in. *TNX Westlink Report No. 662, November 26, 1993.*

## Cuba Incommunicado

Third-party message privileges with Cuba—previously authorized—are no longer approved. According to Rafael Estevez WA4ZZG of Hialeah, Florida, when Hurricane Andrew demolished much of the public communications capability between Cuba and Florida, the Cubans resorted heavily to amateur radio.

The pro-Castro Cuban American Radio Federation has taken a renewed position that Cuban amateurs should not communicate with the "enemy," meaning Florida amateurs of Cuban descent. Rafael says that Cuban amateurs are getting their licenses suspended from three months to a year for passing such innocent non-political health-and-welfare traffic as "... appealing for aspirin and insulin."

CO2QQ advised Rafael on the air recently that the United States and Cuba no longer have a third-party agreement. Information is now moving in and out of Cuba with great difficulty since AT&T's over-the-horizon communication system was damaged by Andrew. *TNX W5YI Report, Issue 23, December 1, 1993.*

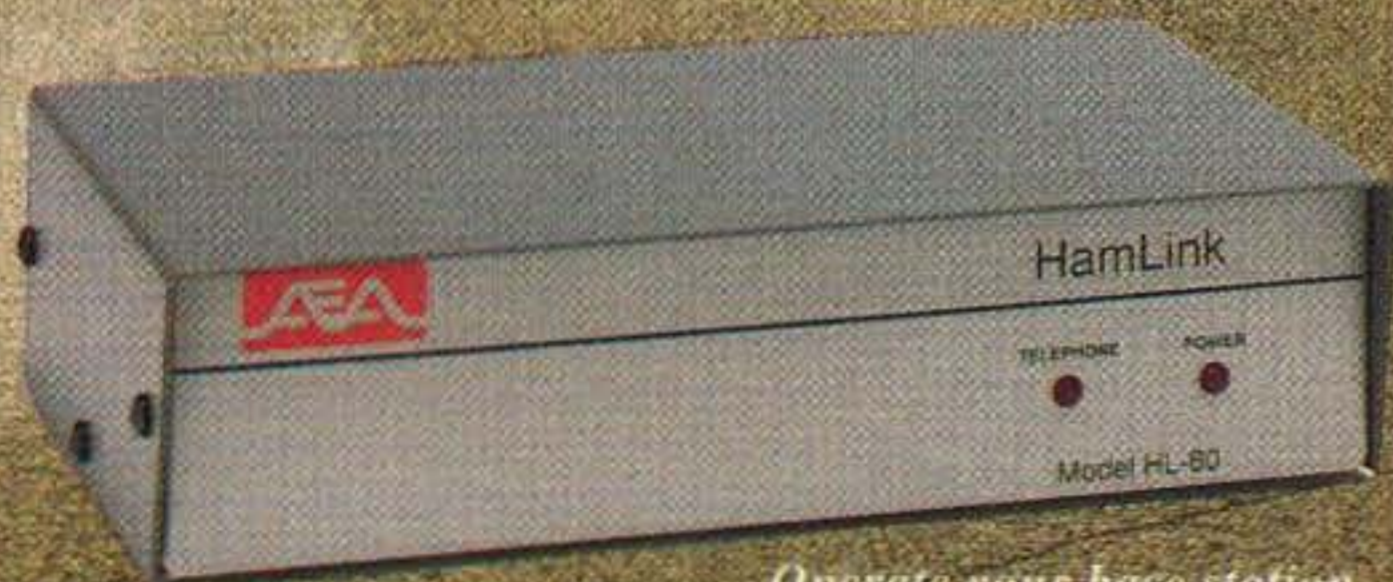
## Power Stream

Three men claim they have invented a battery which is powered by a plentiful natural substance available at low cost—urine. Many scientists are highly skeptical of the inventors' claims, especially without an explanation of the battery's purported chemical reactions and construction.

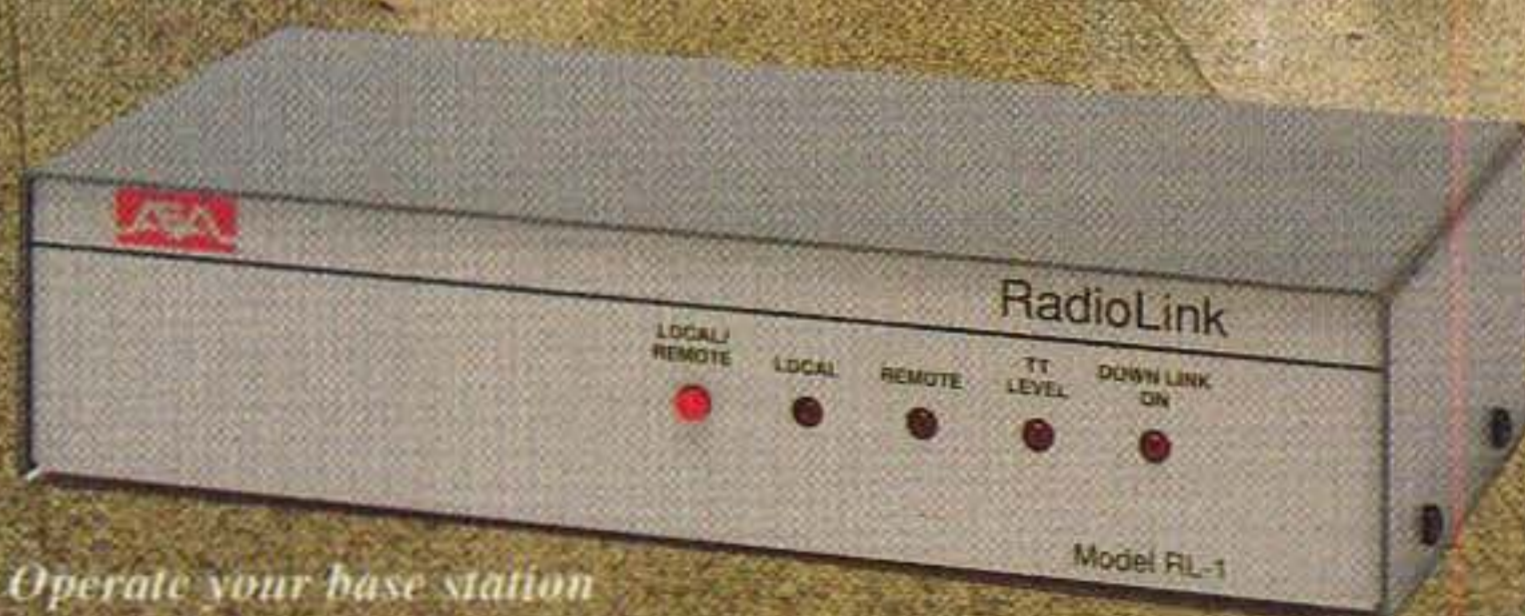
The urine battery's inventors, Nelson E. Camus, Edgar Aguayo, and Ismael Valle, are partners in an electronics company called Nel Nithium Electronics. They say their information is a secret they are not about to share.

The men are looking for investors with \$5 million. They claim their home power plants will be cheaper and smaller than existing power sources, are environmentally sound, and will boost the economy. They estimate the cost to perpetually power an average home to be around \$500. *TNX Associated Press; San Maeto Times; and Palo Alto Amateur Radio Association PAARA Graphs, December 1993.*

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*Connect with us*

# VHF Meteor Scatter Propagation

*Bounce your signal beyond the horizon.*

by Steve Katz WB2WIK/6

I'm writing this after returning home only hours ago from a little expedition to a local mountaintop to work the 1993 Perseids meteor shower, which was supposed to have "peaked" at 0100Z on August 12. Wayne Overbeck N6NB (well-known for his VHF-UHF exploits, as well as for designing the popular "Quagi" antenna) and I headed up to his new mountaintop VHF contesting site at 6,800 feet above sea level in the Tehachapi Mountains, about 90 miles northwest of Los Angeles, to "work" the shower on 50, 144, and 222 MHz. We had some success, but not as much as we had hoped for.

The 1993 Perseids shower was hyped as the biggest news for astronomers, meteorologists and VHFers alike since the return of Halley's comet. Like all meteor showers, this one occurs when bits of debris left by passing comets come close enough to our planet to be pulled in by the earth's gravitational field. Cyclic in nature, meteor showers recur every year at about the same time and there are many showers each year. But *this* one was supposed to be the "big one," with hundreds of meteors falling each hour. It should have had a major impact on VHF propagation and been a wonderful sight to behold, with "shooting stars" filling the sky.

Well, as of today, the shower wasn't what it was hyped to be, and the number of meteors we worked and saw were not all that unusual. But maybe we missed the peak, and the 1993 Perseids may turn out to be all the wonderful things the astronomers said. Either way, it's still fresh in my mind that a lot of hams, newcomers and old-timers alike, don't seem to know much about meteor scatter, and that's the subject of this article.

## Working Meteor Scatter

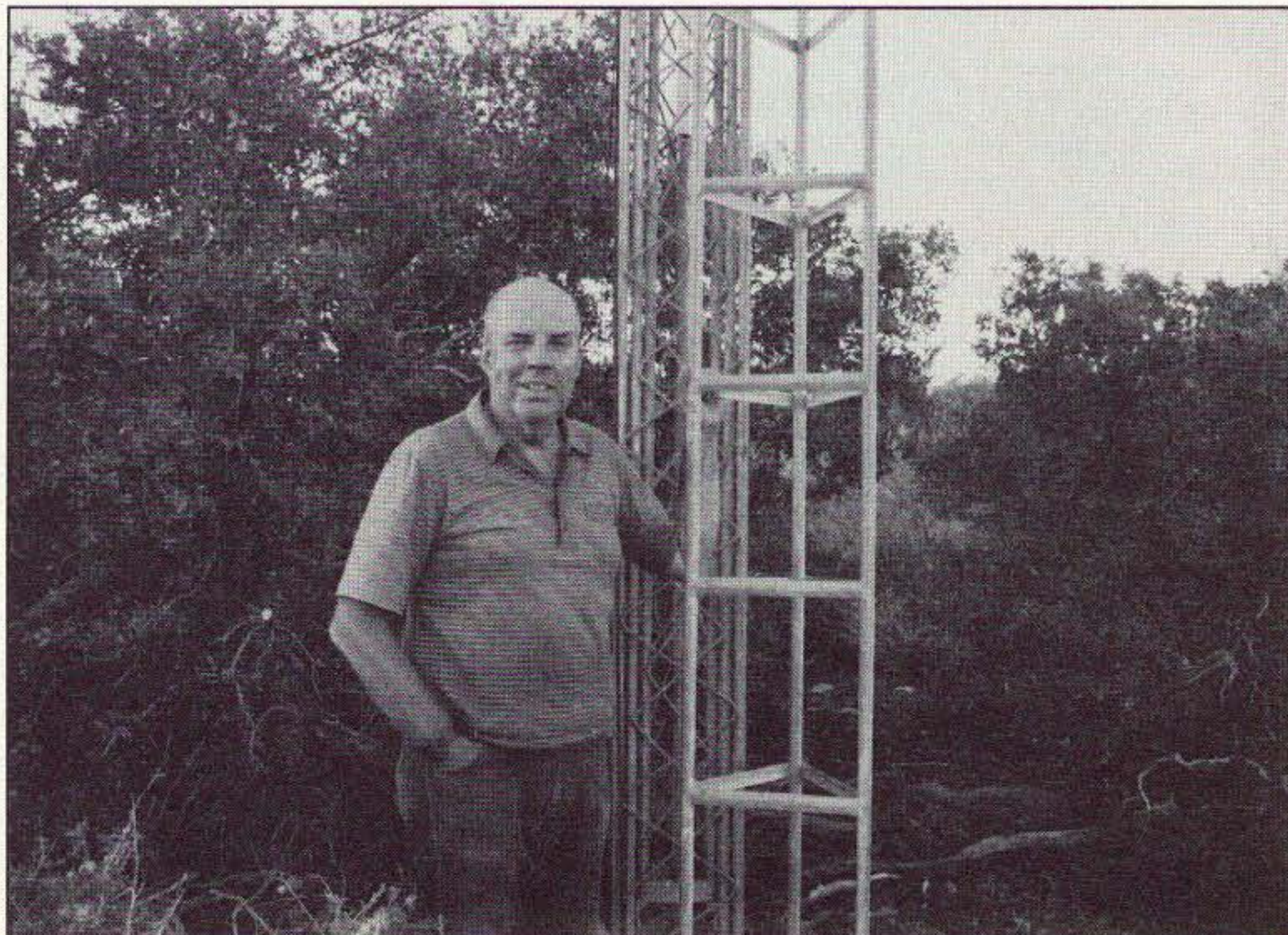
Meteor scatter propagation occurs when signals are reflected off the ionized trails which follow meteors as they enter our atmosphere. In deep space, bodies traveling very fast don't generate any heat to speak of, since they encounter no friction in their travel. But meteors and other bodies entering our atmosphere generate considerable heat as the density of our atmosphere creates friction to their travel. Since our atmosphere contains gasses prone to ionization and even ignition, the meteors literally "burn up" on

entry, and most are extinguished before they reach the surface of our planet. Occasionally, a larger meteor makes it all the way down to earth and plunges into the ground, ocean, or some other obstacle. When a meteor successfully reaches the planet, it becomes known as a meteorite.

The ionization of gasses behind the meteor as it plunges towards earth is highly reflective to radio frequency signals and allows brief reception of distant signals not normally workable on the VHF bands. Random meteors, not members of a known "shower," are workable frequently on 50 MHz year-round, if well-equipped and trained operators are at both ends of the circuit. The meteor scatter signals reflected by a random meteor path may only be present for a few seconds, and another meteor may not come along for a long while. Thus, to complete a contact (or QSO) via a random meteor requires considerable skill on the parts of both operators involved, since all in-

formation must be exchanged in a very short period of time. Signals are typically weak and "peaky," and to successfully work random meteors, high power levels and high gain antennas are usually employed. At higher frequencies like 144 or 222 MHz, even greater skill and better equipment is required because the signals tend to be even weaker (due to path loss, which is related to the number of wavelengths the signals must travel). At 432 MHz, meteor scatter work is rare indeed, although it has been performed.

Think of the ionized trail left by a meteor as a reflector in the sky. Its shape is long and skinny, and it is literally a moving target. It would be impossible to "track" a meteor's path through the heavens, as these bodies are traveling much too fast to steer antennas at them as they travel. And their flight pattern is quite unpredictable. So, to work meteor scatter, most folks find it best to just aim antennas directly towards the station they are trying to contact, keep them fixed on the



*Photo A. Dr. Wayne Overbeck N6NB, who owns the mountaintop operating site used for Perseids 1993. He is leaning on a 50-foot tower erected during the operation(!); a 70-footer to go alongside this one is planned.*

# MFJ HF/VHF SWR Analyzer™

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Has built-in 10 digit LCD frequency counter and smooth vernier tuning.  
You get *three* instruments in one ...

high accuracy frequency counter ... RF signal generator ... *SWR Analyzer™*.

Measure antenna resonant frequencies and 2:1 SWR bandwidths. Adjust mobile antennas, antenna tuners and matching networks in seconds.

Measure feedpoint resistance, inductance, capacitance, resonant frequency of tuned circuits,

transmission line velocity factor/impedance/loss. Test RF chokes, transformers, baluns.

Use 8 AA cells or 110 VAC with MFJ-1312B, \$12.95. 4x2 1/2x6 1/8 inches.

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See free MFJ catalog for complete line of MFJ SWR Analyzers™.

## MFJ-949E 300 W Tuner



**MFJ-949E** World's most popular antenna tuner covers 1.8-30 MHz, has lighted *peak* average Cross-Needle SWR/wattmeter, 4:1 balun for balanced lines and full size 300 watt dummy load.

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Build this regenerative shortwave receiver kit and listen to shortwave signals from all over the world with just a 10 foot wire antenna.

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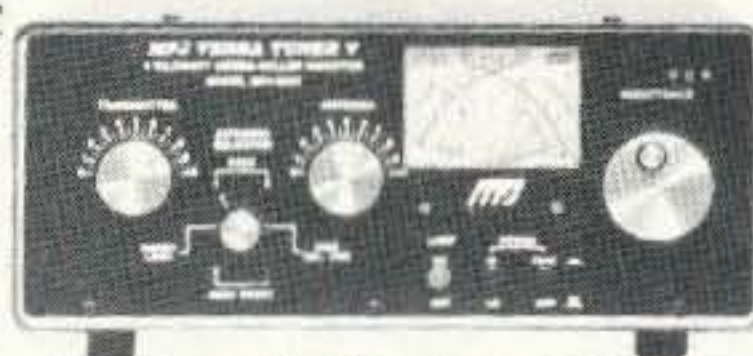
Here's why the MFJ-989C is the finest 3 KW antenna tuner money can buy ...

Two massive 250 pf transmitting variable capacitors can handle amps of RF current and 6000 RF volts. Logging scales.

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## Super Hi-Q Loop Antenna

**MFJ-1786** \$299.95

Tiny 36 inch diameter high efficiency loop antenna covers 10-30 MHz continuously with low SWR. Handles 150 watts.

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All welded construction.

Remote control has Automatic Band Selection™, Cross-Needle SWR/Wattmeter. No control cable needed.

Use batteries or 110 VAC. Add \$20 s/h. No ground or tuner needed.

MFJ-1782, \$269.95, like MFJ-1786 but remote control has only slow/fast tune buttons.



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Mobile Antenna for 144/440 MHz

MFJ dual band magnet mount mobile antenna for 144/440 MHz

has 19 inch stainless steel radiator, low SWR. For mobile rigs with SO-239 UHF connector and handie-talkies with included BNC adapter.

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has stainless steel radiator, 12 ft coax, low SWR. UHF mobile (MFJ-1728) or BNC handie-talkie (MFJ-1728B) connector.

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Photo B. "Antenna's-eye" view from the meteor-scatter operating perch in the mountains at 6,800 feet. The valley floor below the antennas is 3,000 feet lower, and the nearest obstacle of significant elevation is more than 200 miles away.

horizon in that direction, and hope for the best. In this case, hoping for the best is essentially wishing for a meteor to fall between your location and the location of the station you are trying to contact, and for that meteor to be low enough on the horizon that its ionized trail will be a useful reflector. It's actually quite a lot to hope for!

But during a major meteor "shower," when meteors fall at a reasonably fast rate (60 per hour is not unusual), the probability of making contacts by using their reflective "tails" is dramatically increased, to the point where modestly-equipped stations with a small degree of training and skill might successfully complete a few contacts. What is *really* required?

First, realize that meteor scatter (m.s.) signals are weak and "peaky" in nature. By "peaky" I mean they change in strength from literally zero to some workable level and then back to zero again in a very short time, ranging from less than a second to maybe a few seconds. A "zinger" (huge meteor with a long "burn" time) might allow a "burst" that lasts several seconds, but when it's gone, signals will typically fall back to zero again. For these reasons, only "weak signal" modes like SSB and CW have been used effectively for m.s. propagation. Wideband modes like FM are not successfully used, although if tried with a tremendous amount of power and antenna gain, I suppose it might be possible. But remember, signals are typically weak, and CW has a 20 dB signal-to-noise ratio advantage over FM—and that's a whale of a lot. If FM could be used to make the grade at 1,500 watts output power, then just 15 watts would do it on CW. Normally, 15 watt stations are not successful in m.s. work.

So, if you want to expand your horizons on VHF, stick with SSB or CW. (CW was once used almost exclusively for very long DX work on VHF-UHF, including meteor scatter, aurora, moonbounce, etc. But with higher antenna gains, receiver improvements and so forth, SSB is now quite effective and is often faster for making contacts.)

Second, understand that to have any real success in "over-the-horizon" type VHF-UHF work, be it m.s. or normal tropospheric propagation, it pays to have a zero degree or below zero degree horizon in the direction you want to make contacts. If you put your eye at your antenna level and appear to be looking upwards, above level, at the surrounding terrain, you will not be terribly successful at making contacts in those directions where you have this "positive horizon." If you have a "negative horizon" in *any* direction that might be useful in making contacts, use *that* direction for your m.s. work. If your location is such that you have a "positive horizon" all the way around you, it would be wise to pack up the station and go hilltopping (portable from a mountain-top) instead. You'll be much more successful than working from home.

Third, because m.s. path losses are very high and signals are weak, it pays to run as much power as possible. Meteor scatter has been successfully worked with lower power (like 100 watts) but a kilowatt or more sure helps. Keep feedline losses to a minimum and use antennas that have some real gain. But too much antenna gain can sometimes be a hindrance, because a *lot* of gain means a very narrowly-focused antenna system with a sharp front "lobe," and using such a system can make you miss the meteor trails you want to work. Probably 13-15 dB anten-

na gain is the suggested range for most m.s. work, as it is sufficient to make contacts but not so much that an extremely sharp pattern will result.

Fourth, and maybe most important, is operating procedure. Meteor scatter operators must be *quick*! A good "burn" might propagate signals for several seconds. If you operate well and have lightning-fast reflexes, you can complete an entire contact in that time. For a QSO to count, it is usually deemed that exchange of two pieces of information is required. Many years ago, those two pieces of information were a call sign and signal report. Since meteor scatter signals come and go rapidly and it is common to copy only portions of a transmission, an m.s. signal reporting system was established, using the letter "S" followed by a number which indicated how much of the other station's transmission you heard. For example, "S2" meant "I've heard your complete call sign. Now send me something else." It did *not* mean the other station was indicating "S2" on your receiver's S-meter!

Nowadays, with modern equipment, big amplifiers, high-gain antennas, low-loss feedlines, mast-mounted receiver preamplifiers, digital signal processors, etc., I think the old "S" reporting system will be going away. Instead, it would be prudent for stations to exchange call signs and a grid locator. Grid locators are alphanumeric codes used to indicate any station's location with some precision and are internationally rec-

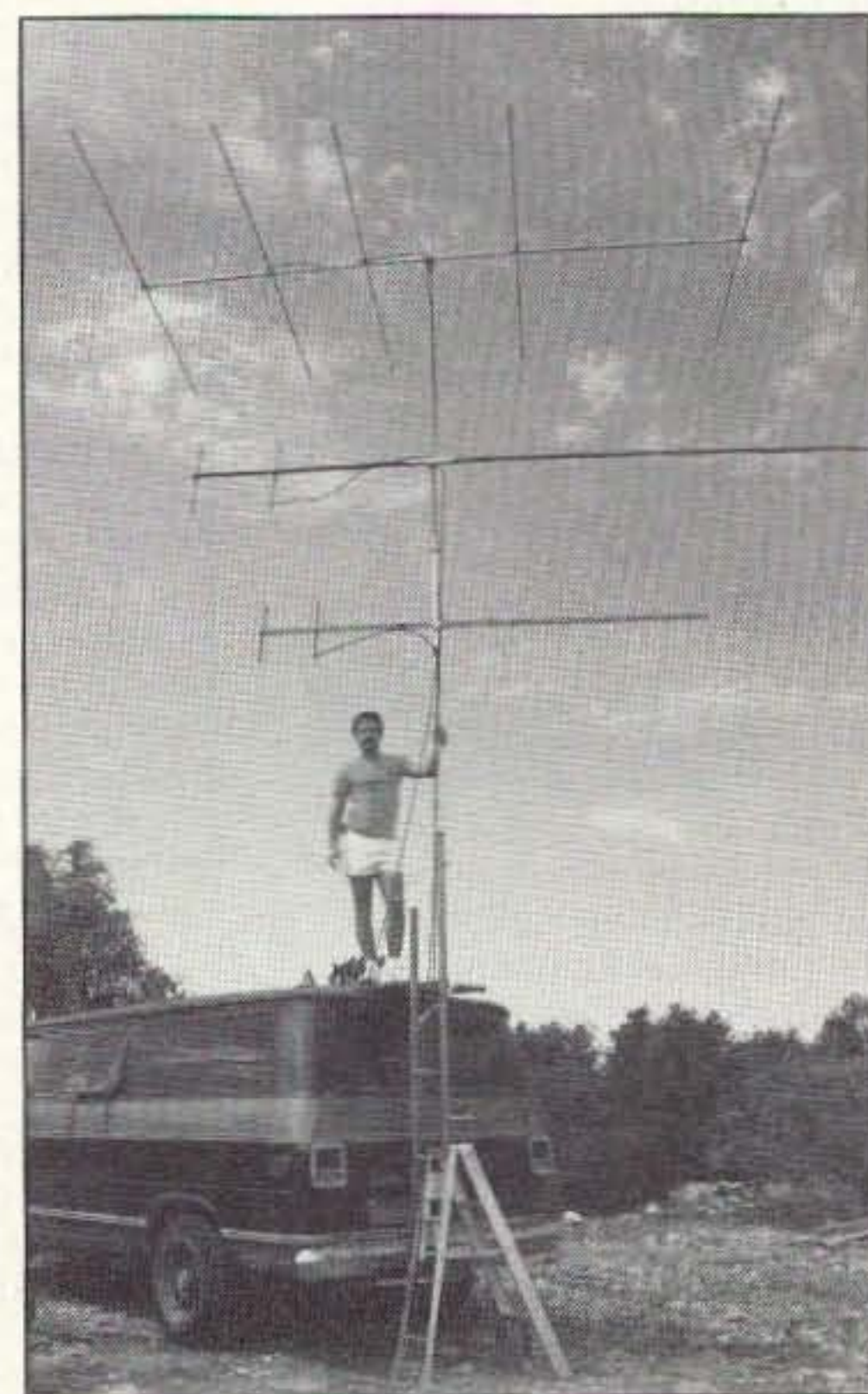


Photo C. The author atop N6NB's van, to the rear of which is permanently mounted a 30-foot telescoping, rotating mast with a HAM-M rotor at the bottom. Portable antennas were simple: five elements on 50 MHz, and eight elements on 144 and 222 MHz. To minimize ground influences, the lowest-frequency antenna goes at the top, highest up.



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High tech performance is the name of the game with this full-featured dual-band handheld. The durable construction lets you take it anywhere and enjoy reliable operation. The unit is equipped with CTCSS, 42 memories, 4 VFOs and 10 auto dialer memories.

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This dual band mobile features 100 memories, cross band repeat, lighted keypad, built-in duplexer and a small footprint. Dual watch capability rounds out this 50/35 watt VHF/UHF transceiver. Packet ready.

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FT-5200



The removable front panel lets this dual bander fit any installation. It features 50w out on 2 meters, 35w out on 70 centimeters, 32 memories, CTCSS encode and PAGE mode.

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IC-3230A



This compact transceiver is loaded with many functions for complete dual band capability, including cross band repeat function, 36 memories, DTMF memory microphone & 3 power levels.

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IC-2GXAT



High power & compact design set a new performance pace. This new HT offers 40 memories, Die cast case, CTCSS, its fresh and exciting from Icom. •IC 2GX with out key pad.

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TH-22AT



Small just got smaller. Kenwood's new TH-22AT is in a category all its own. This new FM transceiver features long battery life, DTMF keypad, user-friendly menu system, scan functions, 41 memories, CTCSS encode, DTSS, and much more.

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IC-R100



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Here's 9 pounds of fun with a display that's easy to see, a front panel that's easy to work and performance to spare. Features include a noise blanker, pre-amp, 100 watts out, 32 memories and great sensitivity.

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Attuned to the fast-moving world of mobile communications, this dual-band transceiver offers many features including a detachable front panel in a compact design.

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Photo D. The author, at the controls of N6NB's contesting van, which contains KW stations for 3.5 through 432 MHz, and a gasoline generator to run it all. Almost like home!

ognized as a standard for VHF-UHF station location information. A four-digit code will indicate your location to within one degree of latitude and two degrees of longitude. Because the earth is an oddly-shaped spheroid (sort of a round ball with a bulging middle), these grids will change in area from point to point on the globe. Grids are not all the same size. They are smallest at the poles, and largest at the equator. But the system is better than nothing, and at least it's a standard. And the ARRL offers VUCC (VHF-UHF Century Club) awards for confirming contacts with numbers of grids (contact the League for more information) and the grid locator number is the standard exchange for most VHF-UHF contests now. Because the grids are fairly large, knowing another station's grid won't help you much if he is close by, but the information is valuable when making distant contacts, say a few hundred miles or more away, for beam-heading directions.

So, I propose (and I see many operators are already doing this) that instead of exchanging meaningless "S" reports, we just exchange call signs and grid numbers to complete meteor scatter contacts. I like change, and I've been working meteor scatter since about 1966; if I can adapt, so can anybody.

### Making the Contact

How does one make a meteor scatter contact? There are two ways: "Random," or unscheduled QSOs, and "skeds," or scheduled QSOs. To make a random m.s. contact, somebody has to call CQ! A typical CQ for m.s. work would be something like this:

CQ WB2WIK CQ WB2WIK CQ  
WB2WIK CQ WB2WIK CQ WB2WIK  
CQ WB2WIK CQ WB2WIK CQ  
WB2WIK CQ WB2WIK BREAK

Note that this is quite different from an ordinary CQ. I've only used two "words": "CQ" and my call sign. All other information

is extraneous and unnecessary. No reason to use words like, "This is . . ." or "in Los Angeles, California," or whatever. All that extra information takes up valuable time and the point in meteor scatter work is to get just the information that is absolutely required across to the other party. If someone heard my CQ, he would likely hear just a little portion of it. Hopefully, he might hear both "CQ" and "WB2WIK," and that's all he needs to know. If he were to answer me, he'd transmit something like this:

WB2WIK W7HAH WB2WIK W7HAH  
WB2WIK W7HAH WB2WIK W7HAH  
WB2WIK W7HAH WB2WIK W7HAH  
WB2WIK W7HAH BREAK

This is all he needed to say. It told me he was calling me, and it told me who he was. Nothing more is required. If I caught a meteor during his transmission, I probably would have heard some portion of this transmission. If I did, then I'd transmit:

W7HAH DMO4 W7HAH DMO4  
W7HAH DMO4 W7HAH DMO4 W7HAH  
DMO4 W7HAH DMO4 W7HAH DMO4  
W7HAH DMO4 BREAK

This would tell Shep (W7HAH, who is indeed a VHF "meteor jockey") that I heard him, and I'm giving him my grid square. You can't assume *anyone* is where you think they should be, and the grid square data is pretty important. For example, in my case, I have a 2-land call sign and lived in grid FN20 in New Jersey for 30-plus years. But I'm not there now! Also, although my license reads "Chatsworth, CA," which anyone can look up to see is in grid DM04, I might have been operating portable somewhere else. The grid is important.

If Shep heard me, he'd probably respond:  
WB2WIK DN26 WB2WIK DN26  
WB2WIK DN26 . . . etc.

or he might just respond with:

QSL DN26 QSL DN26 QSL DN26 QSL  
DN26 QSL DN26 QSL DN26 QSL DN26  
. . . etc., which would indicate he received

my report and is now sending me his.

My last transmission to him, assuming I heard the above, would be:

QSL 73 QSL 73 QSL 73 QSL 73 . . . etc., which would indicate I received his report and am saying good-bye.

You see, simply sending a report on meteor scatter is absolutely no assurance that the other station heard it; thus, the "QSL" or "Confirm" or something *should* also be exchanged to indicate that the stations really heard each other and got everything they needed to make a complete QSO.

In real life, especially in the absence of a major meteor shower, it is common for a complete QSO to take a very long time, because each transmission as outlined might need to be made several times. Typical duration of an m.s. transmission is 15 seconds. Talk *fast*, and you can say quite a lot in that 15 seconds.

Now, what about if you catch a real "zinger" with a long "burn" and you hear the other station's entire exchange in one burst? Do you go into your 15-second routine? Not at all! If I had heard several successive seconds of W7HAH's exchange and he stopped transmitting, I'd immediately reply with:

QSL ALL 73 73 WB2WIK WB2WIK  
QRZ? BREAK

or something like that. I could say all this in less than five seconds and maybe get it all across in one shot, and possibly even stir up another meteor contact in the process. The point is, "make hay while the sun shines," to use a worn-out phrase; that is, take advantage of the meteor for as long as possible and do *not* waste time with a lot of repeating what the other station has probably already copied.

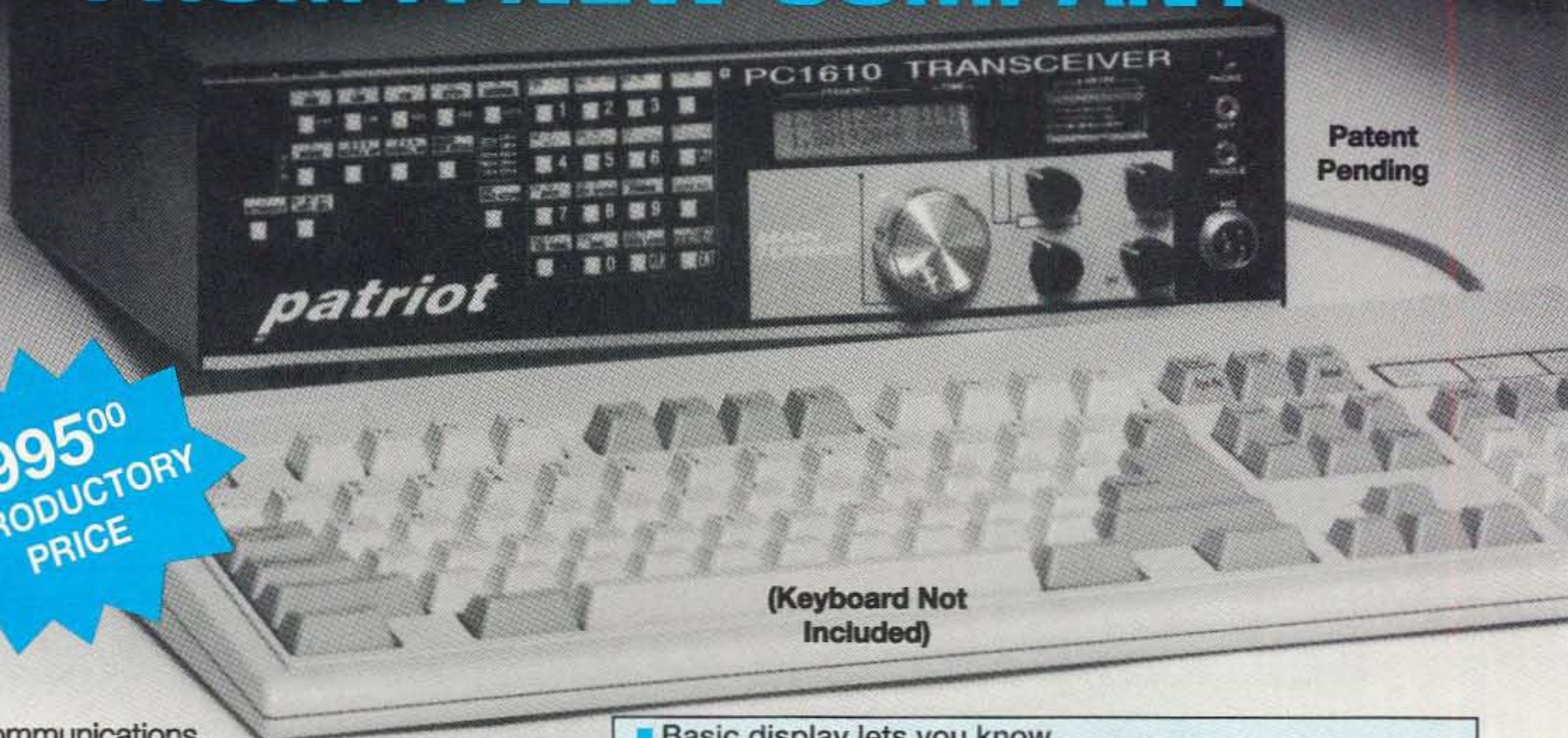
Often, especially for "skeds," or scheduled contacts, transmissions are *sequenced* with station clocks set precisely to WWV. Each station takes a 15-second "turn" at transmitting, and who transmits first is pre-arranged. For example, say it is agreed that the station who is farther west will transmit the first and third 15 seconds of each minute, while the station farther east will transmit the second and fourth 15 seconds of each minute. Of course, both stations must have their clocks set to the second by WWV, and this should be checked just prior to the "sked" time to make sure the clocks are accurately set. The advantage of sequencing is to avoid stations transmitting at the same time, which makes it impossible for them to hear each other.

### How Far, and What Direction?

How far can you expect to work with meteor scatter? *Much* farther than with normal tropospheric propagation! Contacts to 1,500 miles or so are possible, although most will be closer, in the range of 500 to 1,000 miles. Still, this is quite an improvement over what can normally be worked on VHF. Sporadic-E skip, quite common on 50 MHz, often makes only "pockets" workable, and those "pockets" tend to be pretty far away. Very short "E-skip" usually lands at 500 miles or



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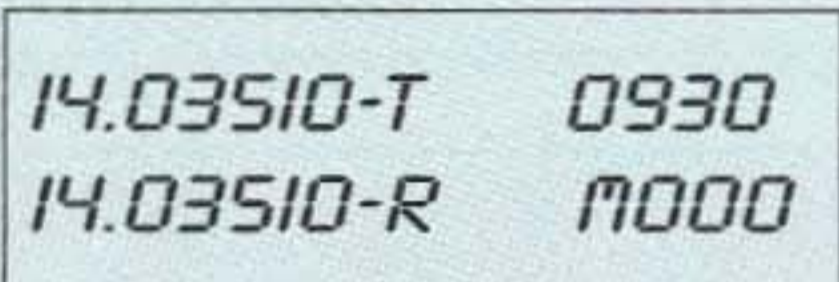
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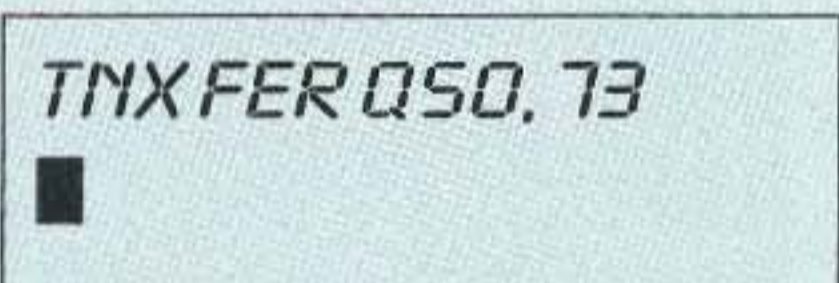
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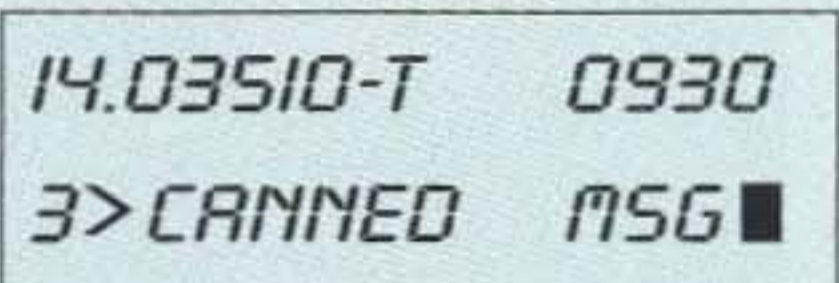
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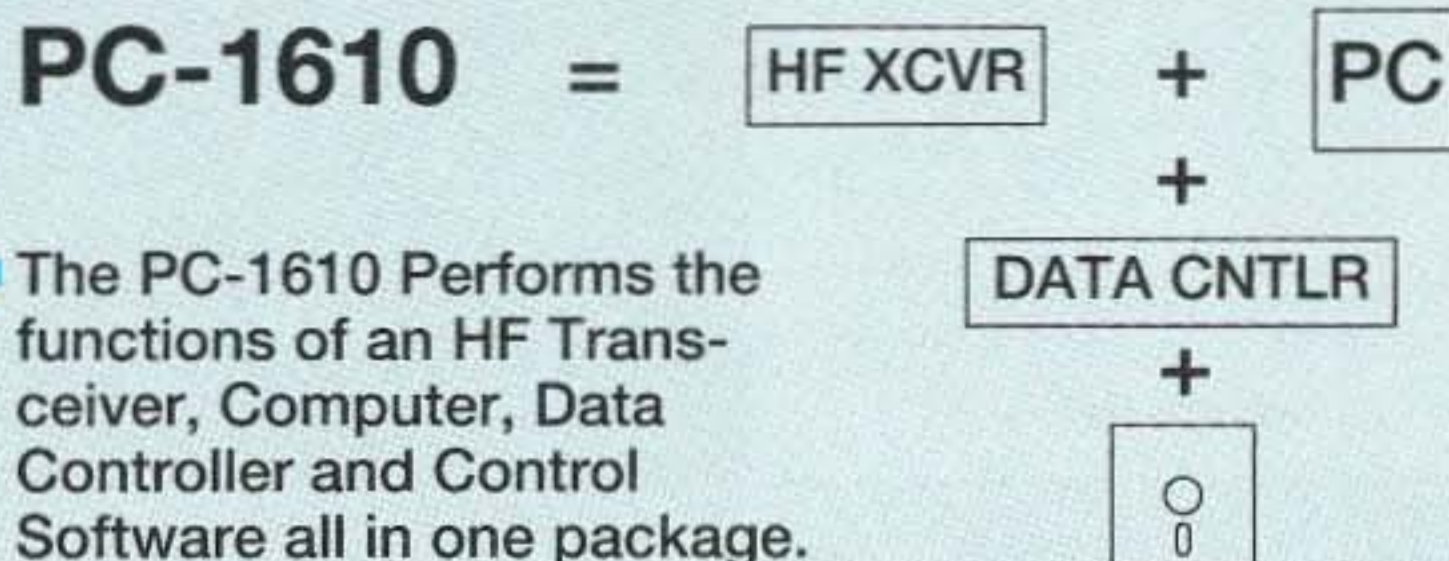


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more, and longer skip arrives from points out to 1,200-1,300 miles. ("Double-hop" E-skip occurs on 50 MHz, allowing double these distances to be covered; combinations of propagation also occur on 6 meters, which allows contacts of almost any distance, but these are rare.) If you are trying to work as many grids or states as possible, relying on E-skip alone can be frustrating. For one thing, E-skip is most prevalent in the June-July timeframe (in the northern hemisphere) and much of the calendar is devoid of E-skip activity. For another, E-skip at frequencies higher than 50 MHz is rare. Tropospheric "ducting" can allow extended-range contacts at 144, 222, 432 MHz and higher, but when the ducts occur, they are often quite narrow with regard to height and width and allow contacts only along a limited path.

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scatter contact. I've made hundreds over almost 30 years, and I still remember mine: It was with K8MMM in Ohio, when I lived in New Jersey. I was running 100 watts PEP output to a little five-element beam on 6 meters, and working Ohio seemed an impossible feat at the time. The distance (500 miles) was too far for normal "tropo," and too close for E-skip. The only way to do it was via meteor scatter. When I made this first m.s. contact, I felt like I invented this new mode. In fact, it had existed for many years and m.s. work was quite common even prior to 1960. I just didn't know. But I know *now*, and now *you* know, too.

Try it—you'll like it. But *please* follow the guidelines for operating listed here. If you don't, your success will be limited and it is easy to become discouraged. If you know a local, highly successful "meteor jockey" (operator who works a lot of meteor scatter), ask him for advice. He should be able to guide you through your first few m.s. contacts.

Oh, by the way: In our Perseids 1993 me-

teor scatter expedition discussed in the opening paragraph and shown in the photographs, we had at least some success. I made 32 scatter contacts on 50 MHz, and four on 144 MHz, in about four hours of operating time. Not too shabby, but not as good as we expected. I think we missed the peak propagation, which likely occurred after we shut down and left the operating site. The best DX on 144 MHz was DM79 in Colorado, about 1,000 miles or so away. We completed QSOs with Indiana and elsewhere east of the Mississippi via meteor-enhanced E-skip (on 50 MHz) and worked DO20 in Alberta, Canada, on 6 meter m.s. without skip. All this, using only small beam antennas (14-foot-long booms) at about 30 feet above ground. But we did run 1,000 watts output on each band, and our location was 3,000 feet above the Mohave Desert floor, which extended in front of us for about 100 miles, so this was a great location!

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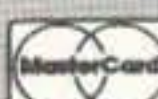
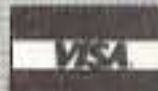
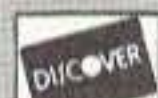
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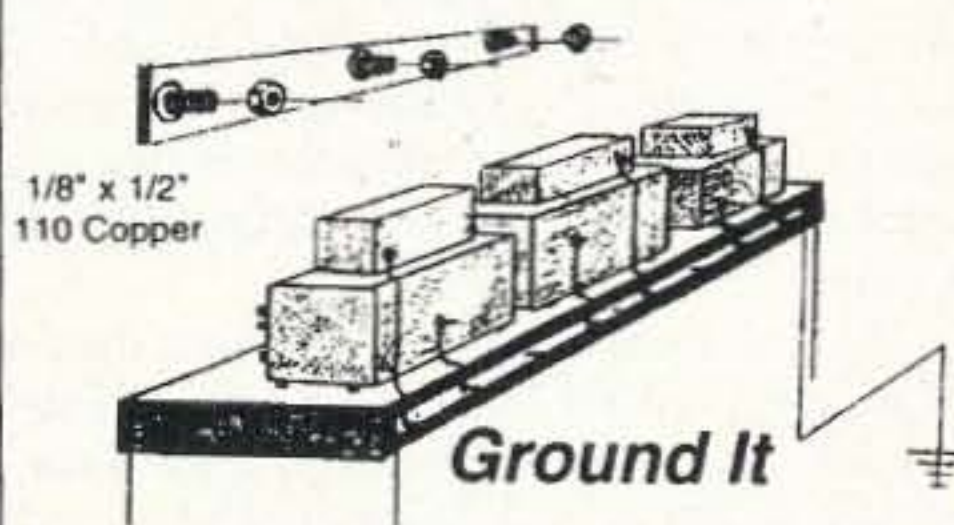
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# Using the World's Most Accurate Frequency Standard, Part 2

## Building a digital phase comparator.

by Bob Roehrig K9EUI

[Editor's Note: This month's installment of this three-part series includes the PC board layout and parts placement diagram for the circuits described in Part 1, published last month. See Figure 5, page 22-23.]

Part 1 of this three-part series described the construction of a receiver for WWVB to be used for calibrating your local frequency standard. If you don't have a good local standard, it's easy to build one that can provide 0.001 part per million accuracy. Such an oscillator will be described in the final article in this series.

A standard with 0.001 ppm accuracy has a drift of less than one cycle in 20 minutes. Even an oscillator with 0.01 ppm accuracy, which I consider to be minimum for a decent standard, must be observed for at least two minutes to determine its drift rate. Clearly, this cannot be done by listening for an audible beat note by ear. The only way to check such a standard is visually.

The simple method of comparison involves using a scope to compare the received signal against the local standard. This method was discussed in Part 1.

A far better method of comparison uses a digital phase comparator. Just what is a phase comparator? Well, the usual forms of detection involve either rectification (to get audio from an IF stage in an AM or FM receiver) or a mixer (in the case of a product detector for SSB or CW). The normal forms of detectors are fine for signals in the audio range, down as low as we can hear, but what

about signals that are less than 1 Hz?

The phase detector is used to compare two signals that are almost exactly on the same frequency. In a way, it is a form of mixer and it works down to fractions of a Hertz (DC actually).

The digital comparator has many advantages over the scope method. It is a much smaller unit than a scope, requires much less power, and is quite easy to build. It also has the capability of feeding a chart recorder or a computer via an A-D converter. The disadvantage in using the comparator is that your input signals must be much cleaner than for a scope.

The basic circuit is nothing more than an edge-triggered set-reset flip-flop. A simple version is shown in Figure 2. Each time a positive-going wave edge is applied to either input A or B, that stage turns on, which turns the opposite stage off. The two signals (A and B) shown in Figure 1 represent two signals that are on the same frequency but A is 90 degrees ahead of B. If these two signals are applied to the circuit shown in Figure 2, the output at point C will be that shown in the bottom line of Figure 1. The output at E will be the DC average of the duty cycle of the signal at C. Since A leads B by 90 degrees, the resulting DC voltage at E will be about 1.25 volts.

If the B waveform shifts to the right so it lags A by 270 degrees, then the voltage at C will be high 75 percent of the time so the average at E will be 3.75 volts. So you can see that as B drifts, compared to A, the average DC output at E will vary between 0 and 5

volts, which represents a 0 to 360 degree phase difference between the two waveforms.

If the DC voltage at E is used to control the frequency of the signal A oscillator, that oscillator will lock to oscillator B. This is a simple form of a phase-locked loop.

Figure 3 shows the real phase detector system. Actually, there are two comparators in this unit. First, a 6 MHz crystal oscillator is divided down to 60 kHz with a pair of decade counters, IC4 and 5. This signal is fed into comparator IC6. The 60 kHz from the receiver is also fed into this comparator. The DC output from the comparator is fed back to D1, which is a variable capacitance diode that adjusts the frequency of the 6 MHz oscillator. In this way, the 6 MHz oscillator is phase-locked to the received signal and has the same accuracy as the WWVB signal.

IC2 and 3 divide the 6 MHz by 6 to get 1 MHz and again by 10 to get 100 kHz. Either one of these is fed into the second phase comparator, IC7. The local oscillator to be checked is also fed into this comparator. In this way we can compare our local 100 kHz or 1 MHz oscillator against WWVB.

The only adjustment to be made is the coarse frequency adjustment, C1 on the 6 MHz oscillator. Connect the 60 kHz output of the WWVB receiver to J2 via coaxial cable. Observe the TP1 signal with a scope. Adjust C1 until an approximate 50 percent duty cycle waveform is observed. Disconnect the receiver signal momentarily, then reconnect it. The 6 MHz oscillator should

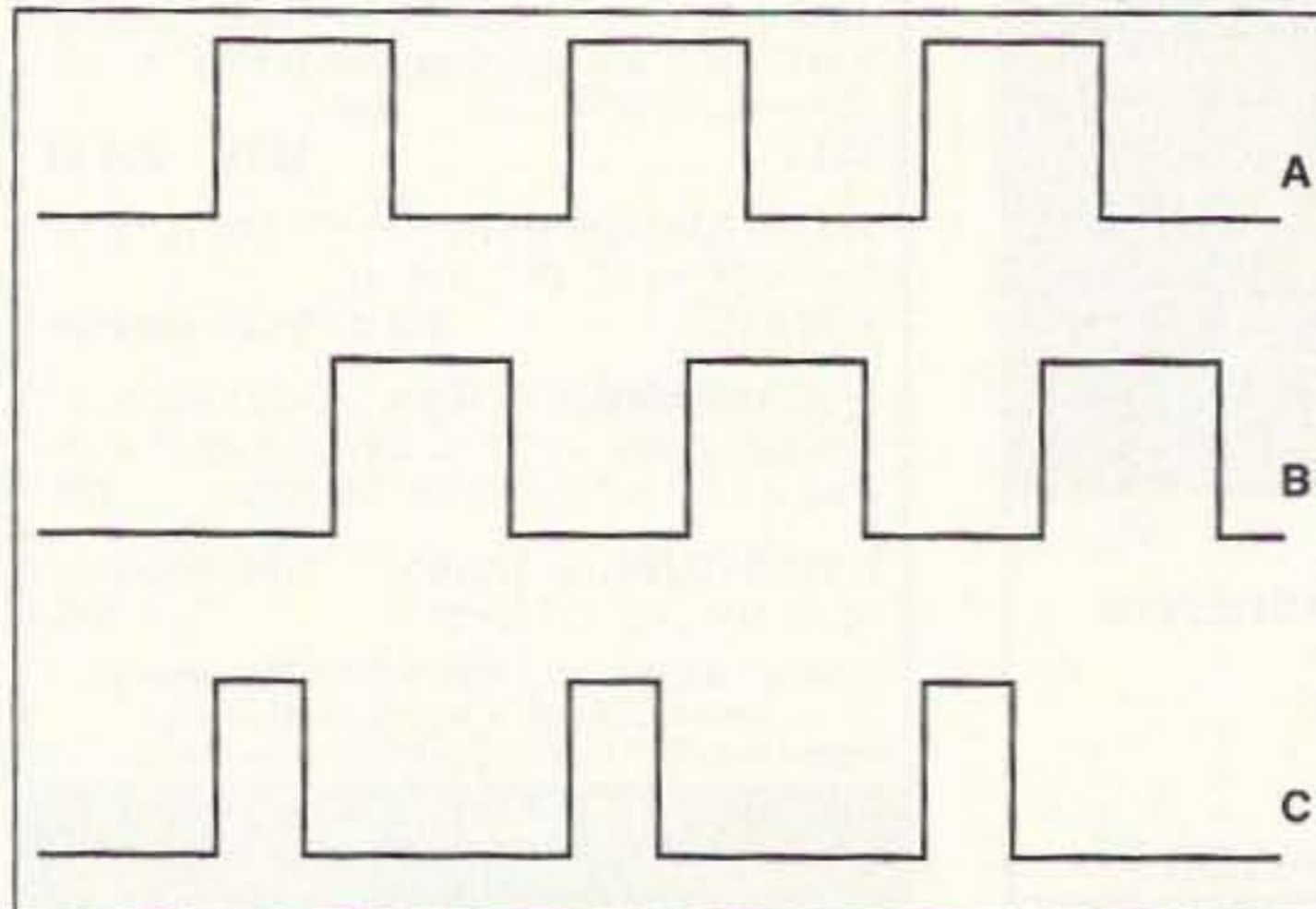


Figure 1. Comparator waveforms.

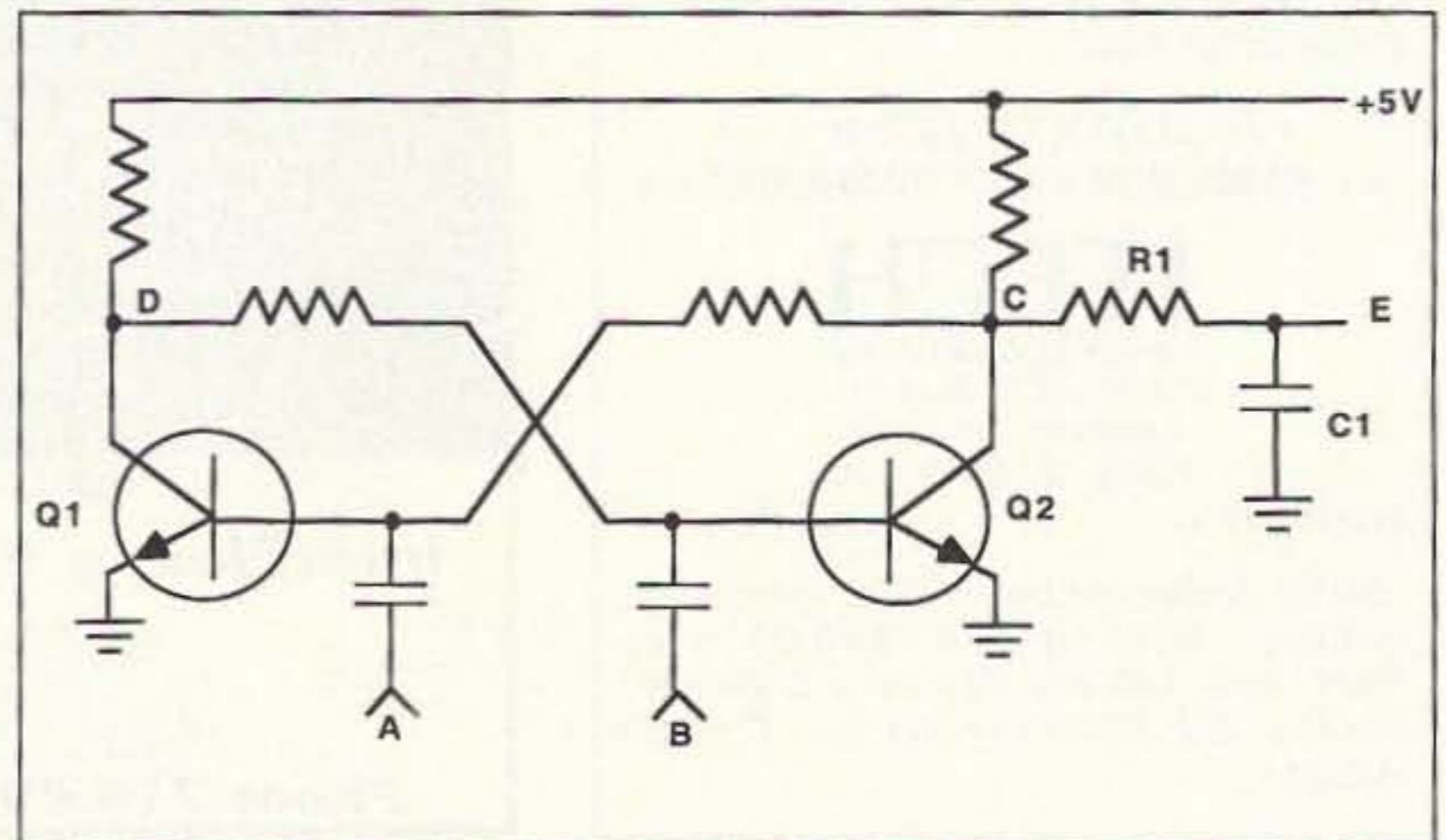


Figure 2. Basic comparator circuit.

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lock on in just a few seconds. If the meter is switched to "INTERNAL," it should read about half-scale.

Even though the crystal oscillator is locked on frequency by the comparator, the

board should be in a location where the temperature is fairly constant. To prevent the high-level 60 kHz signals from being picked up by the receiver input, the board should be mounted in a shielded enclosure.

The meter can be switched to monitor either the 6 MHz oscillator lock voltage (INTERNAL) or the phase difference between the comparator and your local standard (EXTERNAL). The same meter can also be

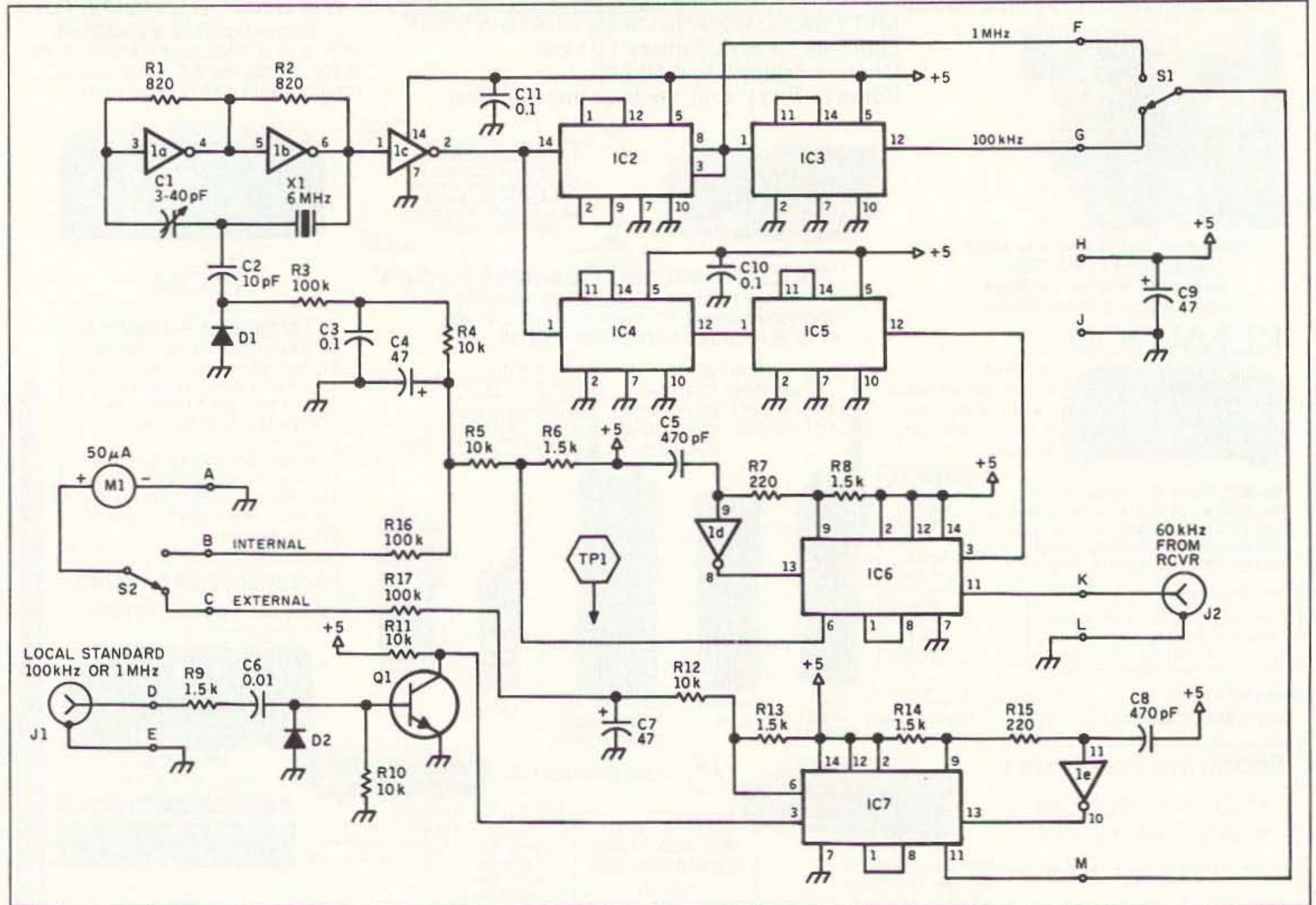


Figure 3. Digital phase comparator schematic.

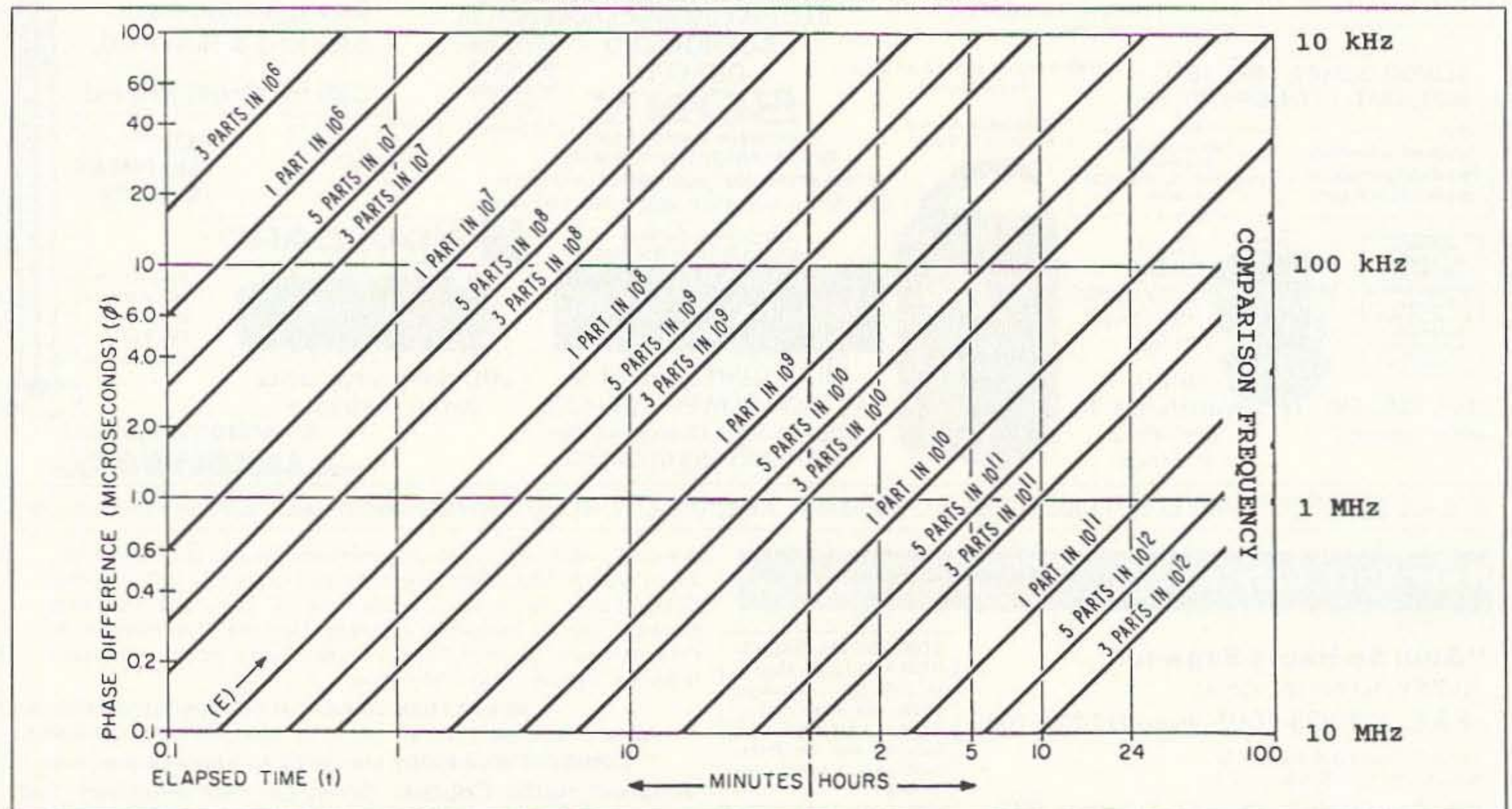


Figure 4. Phase measurement chart.

## ASTRON POWER SUPPLIES

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MODEL VS-50M

### SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

### PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

### SL SERIES



### • LOW PROFILE POWER SUPPLY

MODEL	Colors		Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
	Gray	Black				
SL-11A	•	•	7	11	2 5/8 x 7 5/8 x 9 3/4	12
SL-11R	•	•	7	11	2 5/8 x 7 x 9 3/4	12
SL-11S	•	•	7	11	2 5/8 x 7 5/8 x 9 3/4	12
SL-11R-RA	•	•	7	11	4 3/4 x 7 x 9 3/4	13

### RS-L SERIES



### • POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-4L	3	4	3 1/2 x 6 1/8 x 7 1/4	6
RS-5L	4	5	3 1/2 x 6 1/8 x 7 1/4	7

### RM SERIES



MODEL RM-35M

### • 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-12A	9	12	5 1/4 x 19 x 8 1/4	16
RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
RM-50A	37	50	5 1/4 x 19 x 12 1/2	50
RM-60A	50	55	7 x 19 x 12 1/2	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5 1/4 x 19 x 8 1/4	16
RM-35M	25	35	5 1/4 x 19 x 12 1/2	38
RM-50M	37	50	5 1/4 x 19 x 12 1/2	50
RM-60M	50	55	7 x 19 x 12 1/2	60

### RS-A SERIES



MODEL RS-7A

MODEL	Colors		Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
	Gray	Black				
RS-3A	•	•	2.5	3	3 x 4 3/4 x 5 3/4	4
RS-4A	•	•	3	4	3 3/4 x 6 1/2 x 9	5
RS-5A	•	•	4	5	3 1/2 x 6 1/8 x 7 1/4	7
RS-7A	•	•	5	7	3 3/4 x 6 1/2 x 9	9
RS-7B	•	•	5	7	4 x 7 1/2 x 10 3/4	10
RS-10A	•	•	7.5	10	4 x 7 1/2 x 10 3/4	11
RS-12A	•	•	9	12	4 1/2 x 8 x 9	13
RS-12B	•	•	9	12	4 x 7 1/2 x 10 3/4	13
RS-20A	•	•	16	20	5 x 9 x 10 1/2	18
RS-35A	•	•	25	35	5 x 11 x 11	27
RS-50A	•	•	37	50	6 x 13 3/4 x 11	46
RS-70A	•	•	57	70	6 x 13 3/4 x 12 1/2	48

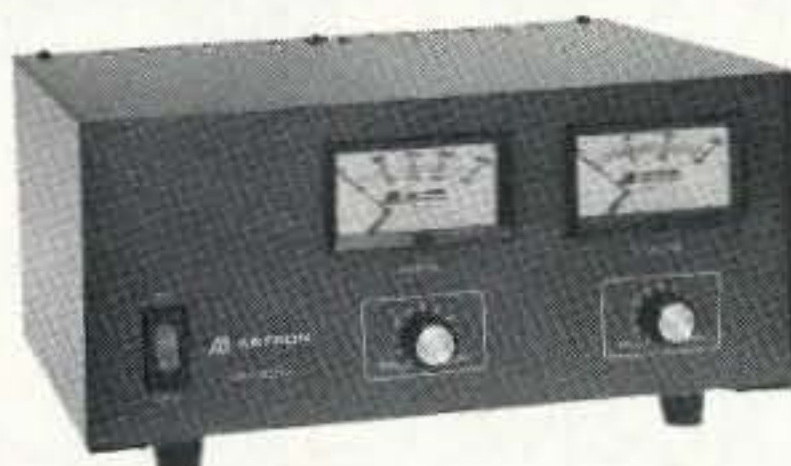
### RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4 1/2 x 8 x 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 3/4 x 11	46
RS-70M	57	70	6 x 13 3/4 x 12 1/2	48

### VS-M AND VRM-M SERIES



MODEL VS-35M

### • Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps)			ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt. (lbs.)
	@13.8VDC	@10VDC	@5VDC			
VS-12M	9	5	2	12	4 1/2 x 8 x 9	13
VS-20M	16	9	4	20	5 x 9 x 10 1/2	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13 3/4 x 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5 1/4 x 19 x 12 1/2	38
VRM-50M	37	22	10	50	5 1/4 x 19 x 12 1/2	50

### RS-S SERIES



MODEL RS-12S

### • Built in speaker

MODEL	Colors		Continuous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt. (lbs.)
	Gray	Black				
RS-7S	•	•	5	7	4 x 7 1/2 x 10 3/4	10
RS-10S	•	•	7.5	10	4 x 7 1/2 x 10 3/4	12
RS-12S	•	•	9	12	4 1/2 x 8 x 9	13
RS-20S	•	•	16	20	5 x 9 x 10 1/2	18
SL-11S	•	•	7	11	2 3/4 x 7 5/8 x 9 3/4	12

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## 5 WAY MULTI-POINT TEST LEADS



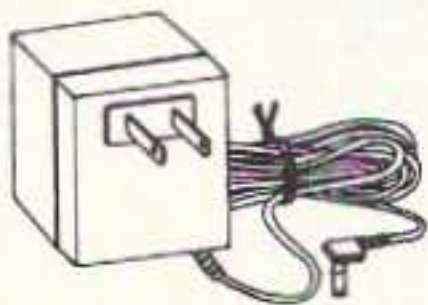
High quality, flexible, cloth covered red and black test leads with telecom industry standard 5 way multipoint test clips on one end and spade lugs on the other end. 5 ways to connect clips: 1) U-shaped nose for qc terminals; 2) Notched jaw for gripping screws, wires or terminals; 3) Serrated teeth for threaded or wire wrap terminals; 4) Cluster of small needles for piercing small gauge wires; 5) Large piercing needle for piercing larger wires. 4 feet long. At one end of the cord is a 1500 ohm resistor that can be switched in and out of circuit.

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10 button, matrix encoded keypad. Peel-and-stick backing for easy mounting. Originally designed for use on a satellite TV tuner, the keys have satellite names and related text on them in addition to numerals 0 through 9. Overall dimensions are 9" X 1.625", but half of the strip can be cut off with a knife or scissors, leaving a self-sticking keypad of 4.5" X 1.625". Silver keys with charcoal numerals and background. 6.5" flexible ribbon cable, terminated with 7 pin socket connector - 0.1" spacing.

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switched to be used as the receiver S-meter. When making phase comparisons, remember that one zero-to-full-scale travel of the meter (360 degrees) is a one-cycle drift. Figure 4 is a phase measurement chart to aid

in determining the accuracy of your local standard. The phase difference, or comparison frequency, is plotted against elapsed time to show the accuracy of your standard. For example, if a 1 MHz oscillator drifts one

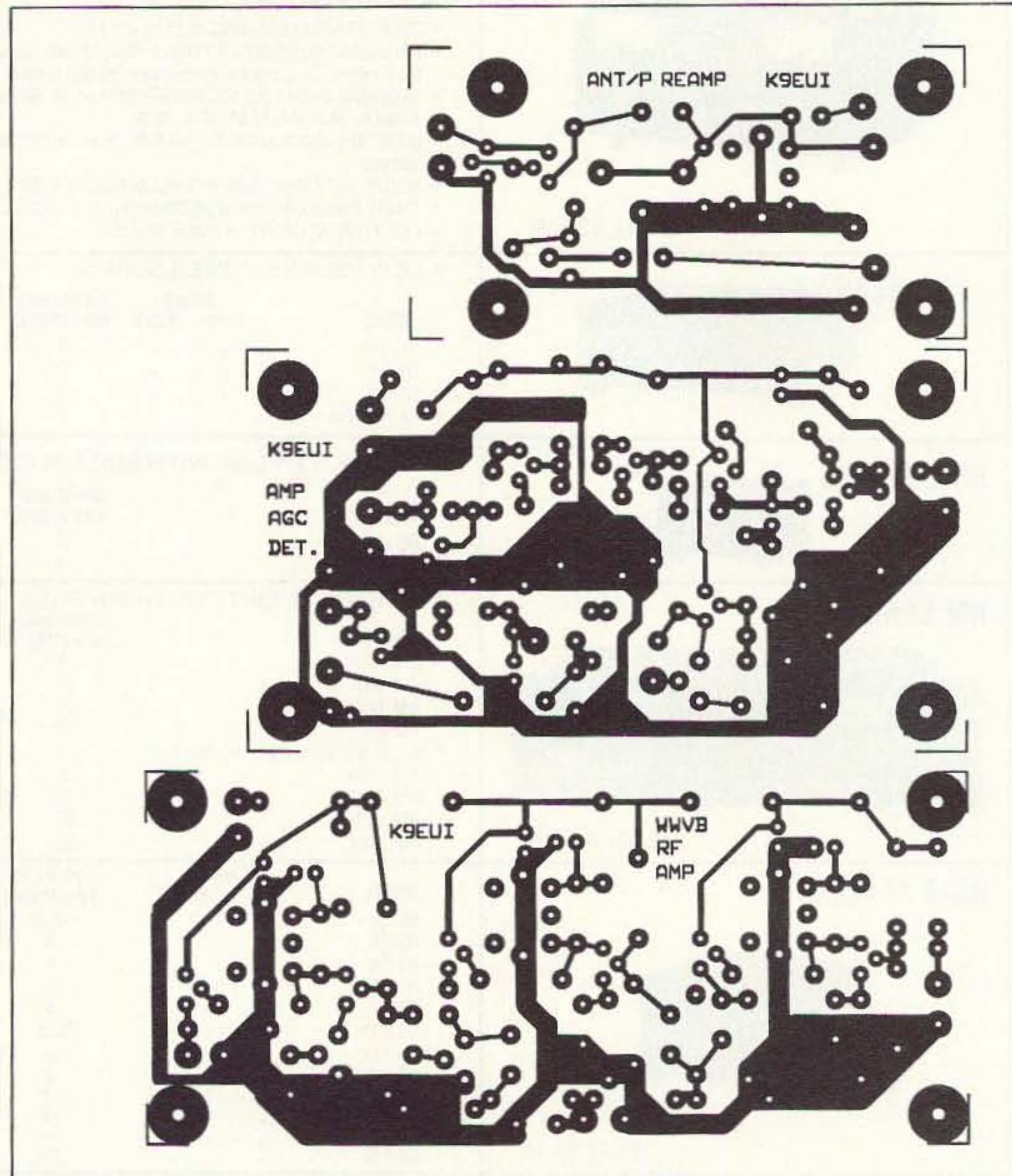


Figure 5. PC board pattern and parts placement

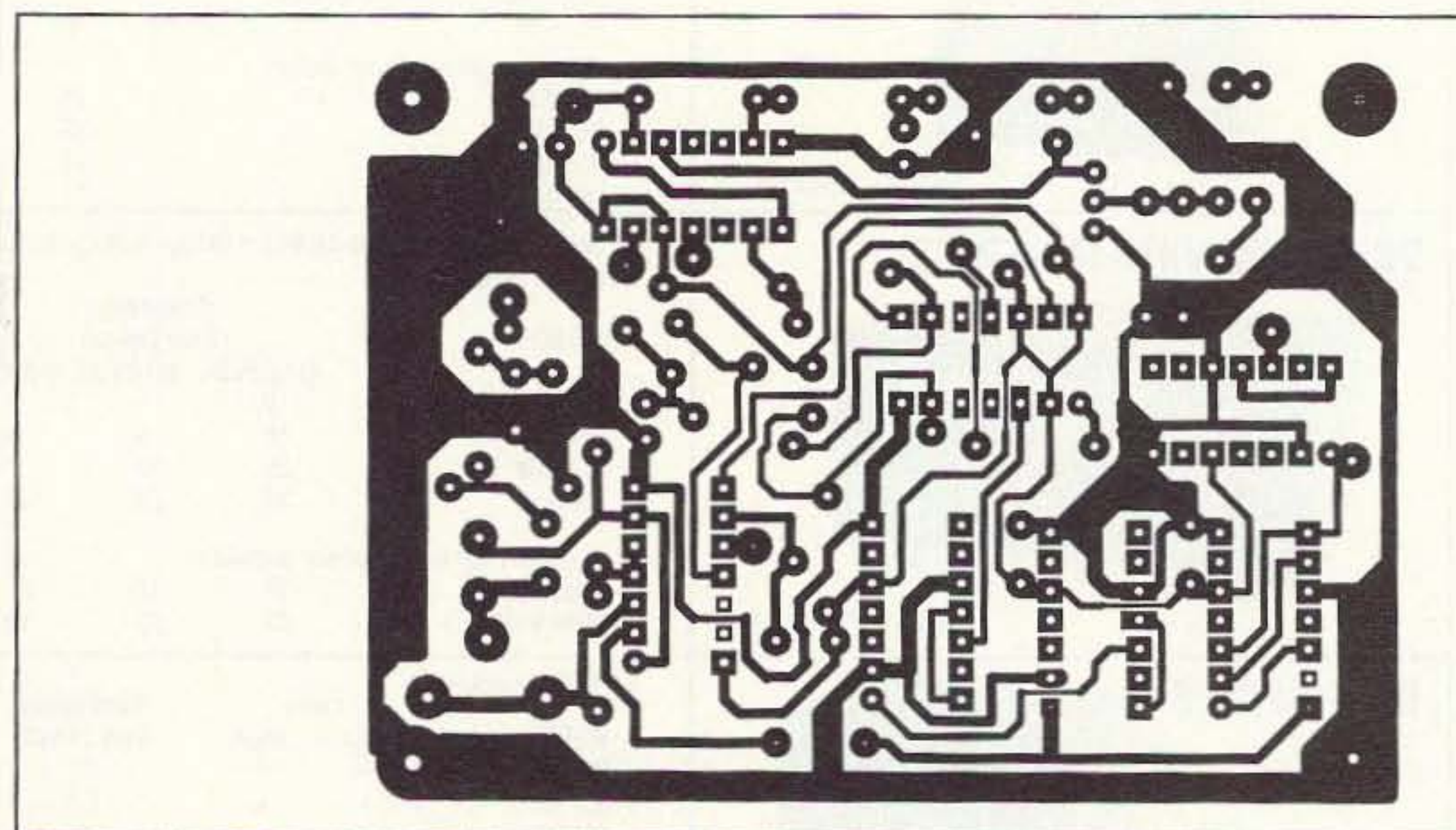
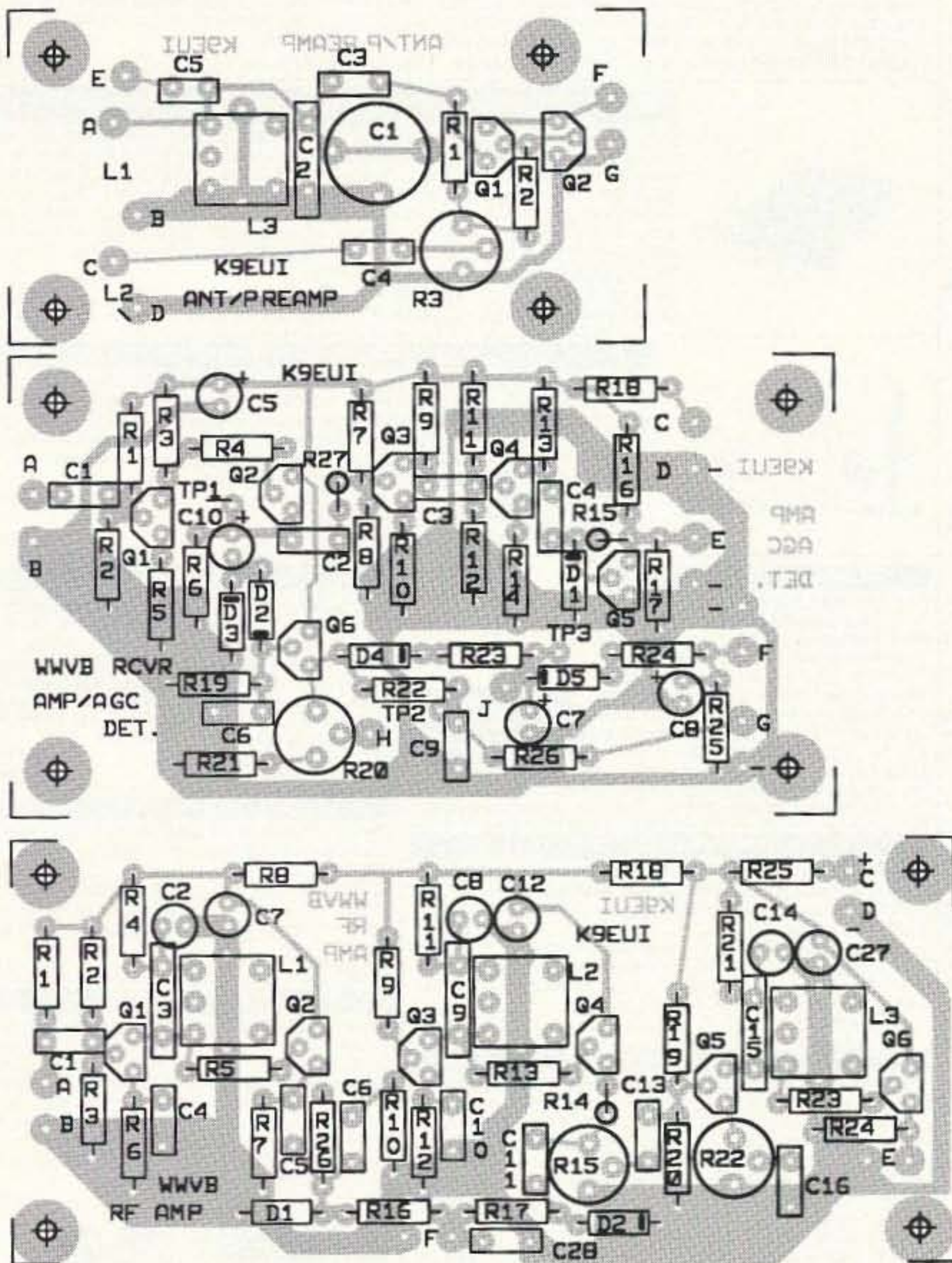


Figure 6. PC board pattern and parts placement

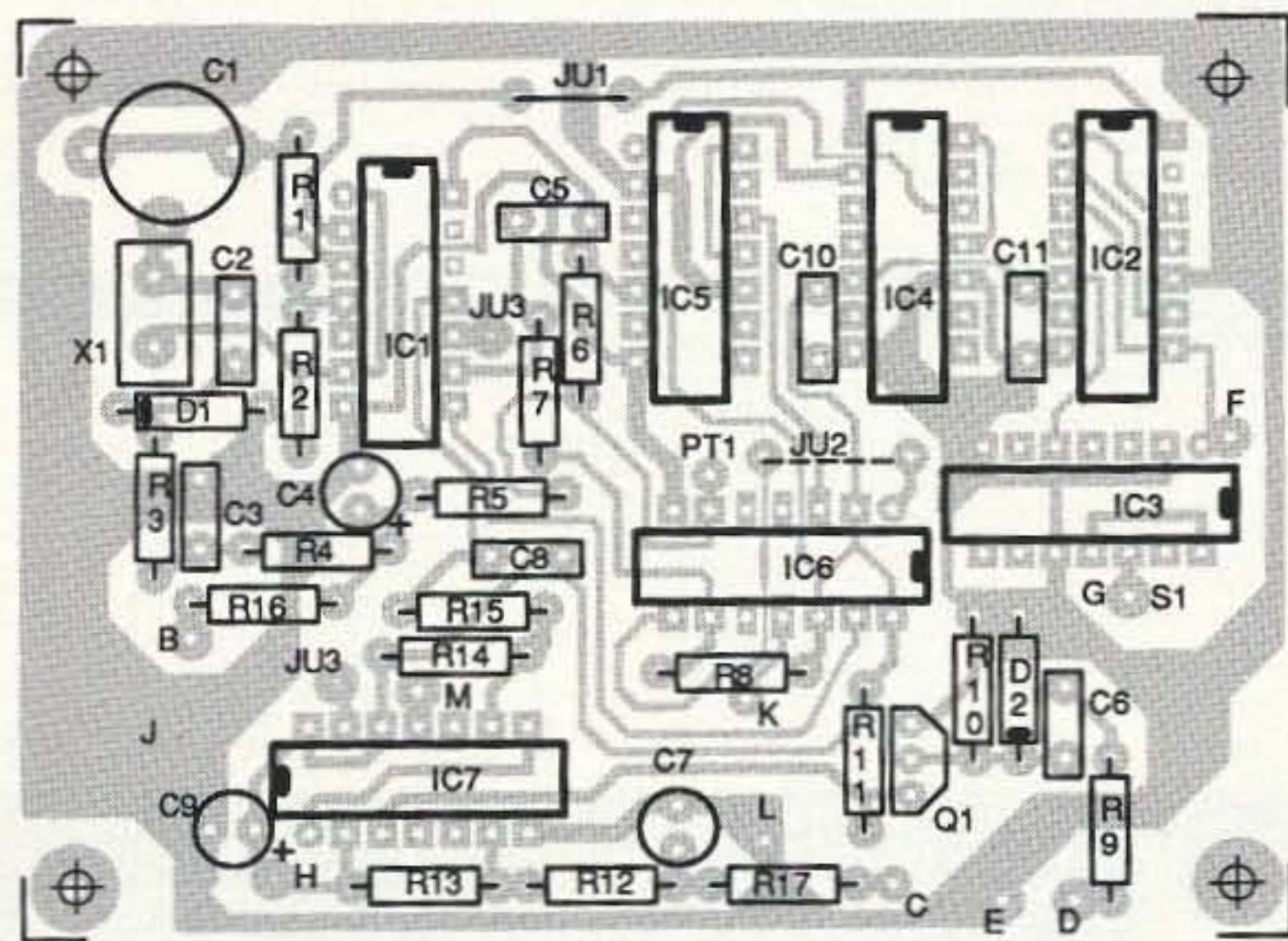


cycle in 20 minutes, the accuracy of that oscillator is one part in  $10^9$ , or 0.001 ppm. If this oscillator is used as a counter time base, your measurement of a 450 MHz signal will be accurate to within 0.45 Hz!

The best times for signal comparison are mid-morning to mid-afternoon and within several hours before and after midnight. During the period of an hour or so before and after sunrise and sunset there is a phe-

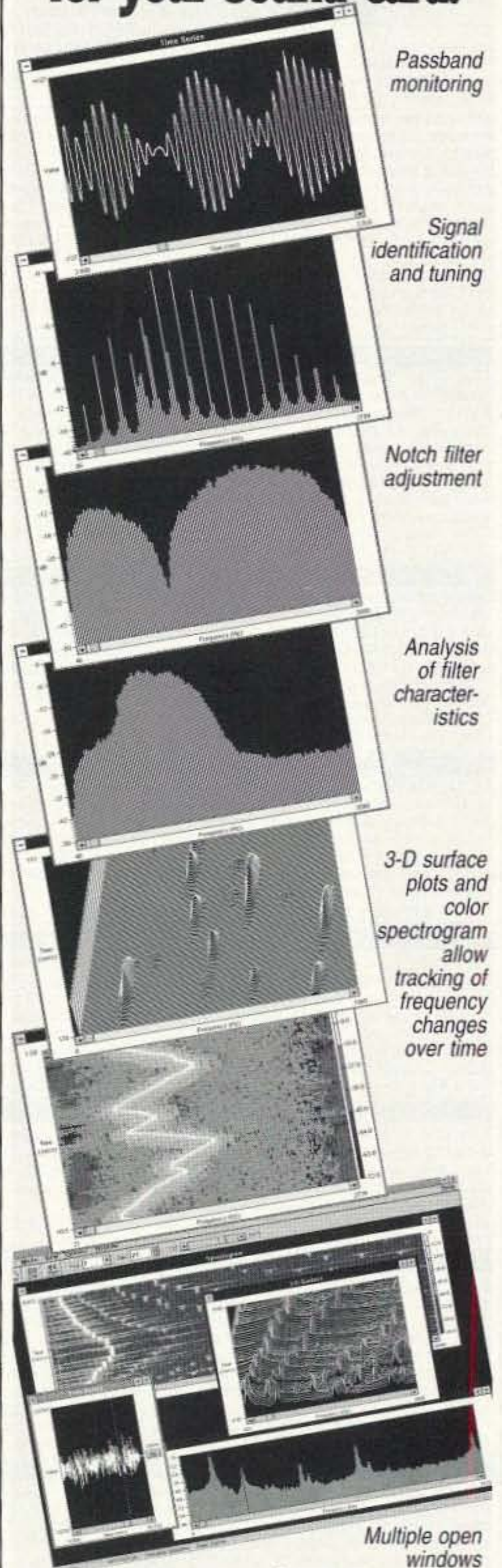


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### FOXHUNT HEADQUARTERS

Locate hidden or unknown transmitters fast. The Foxhound direction finder connects to the antenna and speaker jack on any radio receiver, AM or FM from 1 MHz to 1 GHz. The antenna (a pair of dipole telescopic whips) is rotated until the Null meter shows a minimum. A pair of LEDs indicate to turn Left or Right. The Foxhound is ideal to use with a walkie-talkie, if you wish to transmit, go ahead, a built-in T/R switch senses any transmitted RF and switches itself out of circuit while

you talk. It doesn't get any easier than this! We provide all parts except for a few feet of 1/2 inch PVC pipe available at any hardware store for a dollar or two. Add our matching case set for a complete finished unit. Be the one with the answers, win those transmitter hunts and track down those jammers, you'll do it all with your Foxhound.

Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller. The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics, have a foxhunt!

DF-1 Foxhound direction finder kit .....\$59.95 CDF Matching case set for DF-1 .....\$12.95  
FHT-1 SlyFox Foxhunt transmitter kit .....\$129.95 FHID-1 Voice ID option.....\$29.95  
CFHT Heavy duty metal matching case set for FH T-1 .....\$29.95

### TOUCH-TONE DECODER

Grab Touch-Tone numbers right off the air, phone or tape. A simple hook-up to any radio speaker or phone line is all that is required to instantly decipher touch-tone phone numbers or codes. A 256 digit memory stores decoded numbers and keeps its memory even in the event of power loss. An 8 digit LED display allows you to scroll through the memory bank to examine numbers. To make it easy to pick out number groups or codes, a "dash" is inserted between sets of digits that were decoded more than 2 seconds apart. A "central-office" quality crystal controlled decoder is used allowing rapid and reliable detection of numbers at up to 20 digits per second! For a professionally finished look, add our matching case set. Start cracking those secret codes tomorrow with the Tone Grabber!

TG-1 Tone Grabber kit .....\$99.95 CTG Matching case set.....\$12.95  
TG-1WT Fully assembled TG-1 and case .....\$149.95

### TOUCH-TONE REMOTE CONTROL

Control virtually anything by Touch-Tone remote control. The URC-1 has 16 switched outputs, 4 adjustable voltage outputs (20 mV steps 0 to 5 VDC), two 10K digital pots (for volume, squelch, etc.) and 3 timers adjustable from 10 ms to 40 hours! Two level password control allows secure control and multi-level access. Six digit LED display shows currently entered codes and a crystal controlled touch-tone decoder provides reliable operation. There's nothing else like this unit, be in complete control of remote radios, thermostats, hi-fis, homes or even factories with the URC-1. Add our matching case set for a handsome finish.

URC-1 Remote control kit .....\$129.95 CURC Matching case set.....\$12.95  
URC-1WT Fully assembled URC-1 and case .....\$189.95

### DIGITAL VOICE RECORDER

Chatterbox digital voice storage unit will record your message of up to 20 seconds. Time is split up into four 5 second blocks which can be played separately or cascaded for longer messages. An LED display shows message location and current mode for easy operation. Nifty built-in interfaces allow simple connection to transmitters for automatic keying when the PTT is initially closed or after it is released. You can even loop your rig's mike through the Chatterbox. For contest or fun use, the CB-1 can drive an external speaker. Includes a built-in electret mike. For that finishing touch, add our matching case set.

CB-1 Voice recorder kit .....\$59.95 CCB Matching case set .....\$12.95

### FM SUBCARRIER DECODER

Tap into the world of commercial-free music and data that is carried over many standard FM broadcast radio stations. Decoder hooks to the demodulator of FM radio and tunes the 50-100 KHz SCA subcarrier band. Many radios have a demod output, but if your radio doesn't, it's easy to locate, or use our FR-1 FM receiver kit which is a complete FM radio with a demod jack built-in. These "hidden" subcarriers carry lots of neat programming - from stock quotes to news to music, from rock to easy listening - all commercial free. Hear what you've been missing with the SCA-1.

SCA-1 Decoder kit .....\$24.95 CSCA Matching case set .....\$12.95  
FR-1 FM receiver kit .....\$19.95 CRR Matching case for FR-1 .....\$12.95

### SCANNER CONVERTER

Tune in on the 800-950 MHz action using your existing scanner. Frequencies are converted with crystal referenced stability to the 400-550 MHz range. Instructions are even included on building high performance 900 MHz antennas. Well designed circuit features extensive filtering and convenient on-off/bypass switch. Easy one hour assembly or available fully assembled. Add our matching case set for a professional look.

SCN-1 Scanner converter kit .....\$49.95 SCN Matching case set .....\$12.95  
SCN-1WT Assembled SCN-1 and case .....\$89.95

### STEREO PEAK HOLD BARGRAPH

Finally a dual LED bar graph with a peak hold display! Bar graph displays are neat and eye catching but their speed is their downfall - they just can't capture the peaks. Our kit is like two units in one, a fast display to show the signal and a long persistence display to capture peaks. Similar units go for hundreds of bucks! We offer 3 models: Linear for general use. Semi-Log for audio VU meters, and Log for power displays. Dual - for stereo! - 10 segment multi-colored LED display for snazzy, eye grabbing display and easily set ranges for virtually any signals, from voltmeters to audio VU meters to audio power amps to SWR meters. Complete instructions for easy hook-up to most any device. Add our matching case set for a sharp looking unit.

PH-14 Dual Linear bargraph kit .....\$39.95 PH-15 Dual Log bargraph kit.....\$39.95  
PH-16 Dual Semi-Log bargraph kit .....\$39.95 CPH Matching case set .....\$12.95

### SURROUND-SOUND/REVERB

Add concert hall realism to your stereo, TV or even 2-way radio! Easily synthesize a stereo effect from mono sources or richly enliven regular music. Add a big-voice reverb to your radio voice that others will envy! Our reverb/surround sound kit uses a Bucket Brigade IC Device for reliable solid-state performance. Adjustable reverb, delay and mix controls to customize your sound. Easily connected to radios, stereos, CB's and TV's. Plenty of audio to drive a small speaker for stand-alone operation too. Experience the fun and realism that surround sound provides - without spending hundreds! Add our case set for a neat, pro look.

RV-1 Surround Sound/Reverb kit.....\$59.95 CRV Matching case set .....\$12.95  
RV-1WT Assembled RV-1 and case .....\$99.95

### SPEED RADAR

New low-cost microwave, Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual Doppler shift. Uses two 1-1/2 coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

SG-7 Complete kit .....\$89.95

### FM RECEIVERS & TRANSMITTER

Keep an ear on the local repeater, police, weather or just tune around. These sensitive superhet receivers are fun to build and use. Tunes any 5 MHz portion of the band and have smooth varactor tuning with AFC, dual conversion, ceramic filtering, squelch and plenty of speaker volume. Complete manual details how the rigs work and applications. 2M FM transmitter has 5W RF out, crystal control (146.52 included), pro-specs and data/mike inputs. Add our case sets for a nice finish.

FM Receiver kit Specify band: FR-146 (2M), FR-6 (6M), FR-10 (10M), FR-220 (220MHz) .....\$29.95  
CFR Matching case set .....\$12.95 FT-146 Two Meter FM transmitter kit .....\$79.95



### 20 METER SSB/CW TRANSCEIVER DDS • DUAL VFO • BUILT-IN KEYS

Imagine taking this cute little 20 Meter SSB/CW rig on business trips or vacations, there's feature galore with this beauty! A DDS (Direct Digital Synthesis) synthesizer tunes in 10 Hz steps, two VFO with memory and digital RIT with freq display! Convenient features like a dial fast button allows you to hop around the band and dual selectable AGC allows comfortable operating. Instant, one-touch WWV reception for quick band condition checks and microprocessor control with built-in lambda CW keyer that has digital readout of speed! Perky 10 watt RF output (only 1 1/2 S units below 100 watts) can be turned down for ORP. Includes hand mike with handy Up/Down buttons for easy remote tuning. This rig's a joy to operate, with performance equal to units costing hundreds of dollars more and with some features not

found on any rig at any price! Covers the 20 M band 14 -14.5 MHz plus 15 MHz WWV. Our easy to follow instructions have you assemble the kit in simple "bite-sized" sections that are tested as you build, assuring you of a rig that works first time. Experience the pleasure of saying the rig here is home-brew! Available in kit or fully wired.

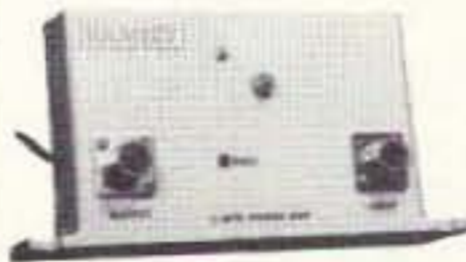
SX-20 SSB/CW transceiver kit .....\$349.95 SX-20WT Fully assembled SX-20 .....\$429.95



### FANTASTIC FM TRANSCEIVERS SYNTHESIZED—NO CRYSTALS

Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? ...No problem. Twelve diode programmed channels, 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-50 kit (6 Meters) .....\$149.95 FX-146 kit (2 Meters) .....\$149.95  
FX-223 kit (1 1/4 Meters) .....\$149.95 FX-440 kit (3/4 Meters) .....\$169.96



### 2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)  
Fully wired & tested .....\$89.95

PA-20 220 MHz POWER BOOSTER (8 X power gain)  
Fully wired & tested .....\$89.95

### STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

FM-10A Stereo transmitter kit \$34.95 CFM Case, whip ant set.....\$12.95

### FM WIRELESS MIKES

Pick the unit that's right for you. All units transmit a stable signal in the 88-108 MHz FM band up to 300' except for High power FM-4 and PB-1 Phone bug that go up to 1/2 mile.

FM-1 Basic unit .....\$5.95  
FM-2, as above but with added mike pre amp .....\$7.95  
FM-4, long range with very sensitive audio pickup .....\$14.95  
PB-1, Phone bug needs no battery, hooks to phone line.....\$14.95  
MC-1, Micro size sensitive mike cartridge for FM-1,2,4 .....\$2.95

### SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scrambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

SS-70 Scrambler /descramblerkit .....\$29.95  
CSSD matching case set .....\$12.95  
SS-70WT Assembled SS-70 and case set.....\$69.95



### AIRCRAFT RECEIVER

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth

varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit .....\$24.95  
Matching case set, CAR .....\$12.95

### QRP TRANSMITTERS RECEIVERS LINEAR AMPLIFIERS

#### 20, 30, 40, 80M CW TRANSMITTERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a S30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.

Your choice of bands (Specify band: QRP-20, 30, 40, or 80) .....\$29.95  
Matching case .....\$12.95  
knob set, CQRP .....\$12.95

#### 20, 30, 40, 80M All Mode RECEIVERS

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602, IC as featured in QST and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.

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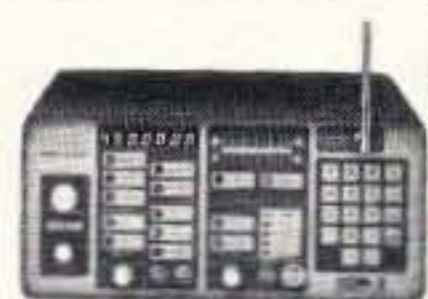
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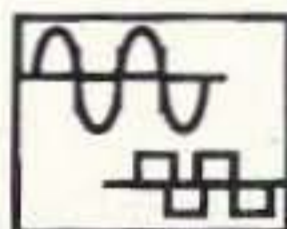
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KHz to 999 MHz • 100 Hz resolution to 500 MHz, 200 Hz above • -130 to 10dBm output range • 0.1 dB output resolution • AM and FM modulation • 20 programmable memories • Output selection in volts, dB, dBm with instant conversion between units • RF output reverse power protected • LED display of all parameters—no analog guesswork!

RSG-10 Synthesized Signal Generator.....\$2495.00

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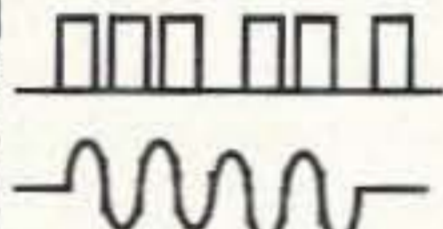
DDS (Direct Digital Synthesis) technology brings you a terrific audio generator at a fantastic price! Generates from 0.01 Hz to 50 KHz with five digit LED display of frequency. Sine and square wave output adjustable 0-1 volt p-p. Frequency selected by direct keyboard entry and with handy continuous

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LC-1 LC meter kit.....\$34.95 CLC case set.....\$12.95

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Ramsey carries a complete line of low cost, easy to build, easy to use functional kits that can be used alone or as building blocks in larger more complex designs. Mini-kits include audio amps, tone decoders, VOX switches, timers, audio alarms, noise-makers and even shocking kits! Call for our free catalogue!

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AA-7Kit.....\$24.95 Matching case & knobset, CAA.....\$12.95

### CW KEYS

Send perfect CW. Microprocessor keyer features 4 programmable memories of up to 26 words each, lmbic keying, dot-dash memory, variable speed from 3-60 WPM, adjustable sidetone, keying to any rig and fully RFI proof. EPROM memory keeps messages up to 100 years - you'll go silent before the key! Includes built-in touch paddles or use your own. Easy assembly and matching case set available for a nice station look.

CW-700 Micro keyer kit.....\$69.95 CMK Matching case set.....\$12.95 CW-700WT Assembled CW-700and case.....\$99.95

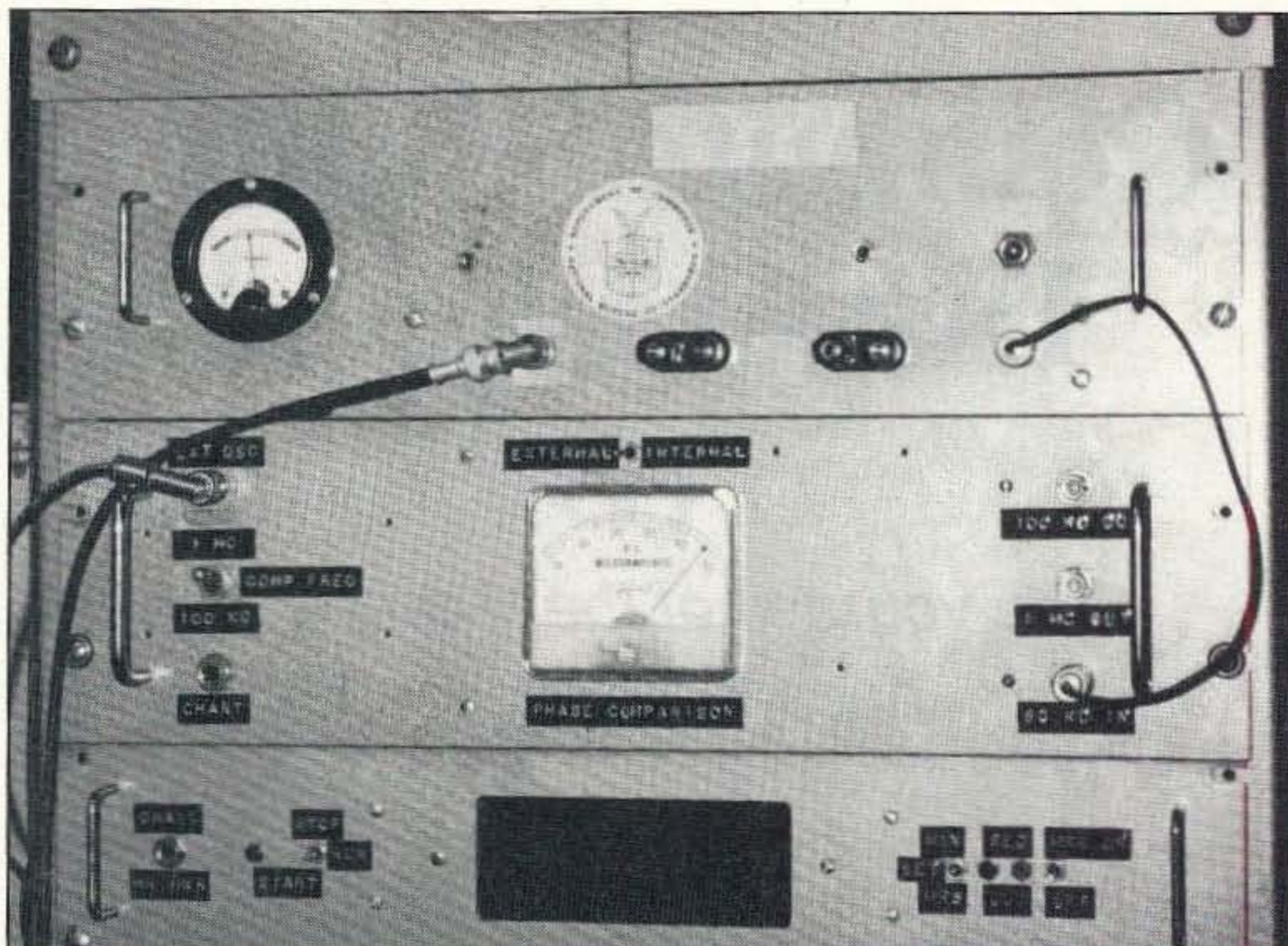


Photo A. Rack-mounted prototypes: Top unit is the 60 kHz WWVB receiver, center unit is the phase comparator, and the bottom unit is a digital clock.

nomenon called diurnal shift when the "E" layer comes and goes. No serious measurements should be made at this time. At certain distances from WWVB, the skywave and ground-wave signals can cancel each other at this time, making the signal disappear. Remember that at 10 minutes past the hour the phase of the WWVB carrier is advanced 45 degrees, and at 15 minutes past the hour the phase is returned to its original value.

The comparator could have been made simpler by just dividing both the 60 kHz received carrier and the local 1 MHz oscillator down to the common frequency of 10 kHz.

However, the observation period for the same accuracy would be 100 times as long. For this reason the synthesizer/PLL circuit using the 6 MHz oscillator was chosen.

After observing the phase comparator in action, it will soon become apparent why the WWVB signal cannot be used directly as a time base for a counter. You will notice the short-term jitter that would make frequency measurements unreliable.

The third and final part of this series dealing with using WWVB will detail the construction of a stable precision 1 MHz crystal oscillator for use as a local standard.

73

### Digital Phase Comparator Parts List

(All resistors 1/4 watt)

Desig.	Value	Digi-Key #
R1,2	820 ohms	
R3,16,17	100k	
R4,5,10,11,12	10k	
R6,8,9,13,14	1.5k	
R7,15	220 ohms	
C1	3-40 pF trimmer	SG3008
C2	22 pF	P4841
C3,10,11	0.1 $\mu$ F	P4525
C4,7,9	47 $\mu$ F	P810
C5,8	470 pF	P4808
C6	0.01 $\mu$ F	P4513
IC1	74LS04	DM74LS04N-ND
IC2-5	74LS90	DM74LS90N-ND
IC6,7	74LS74	DM74LS74N-ND
IC sockets	14-pin DIP	AE8914
D1	1N4001	
D2	1N914 or 1N4148	
Q1	2N2222 or equiv.	
X1	6 MHz parallel load 32 pF XTAL	X413

A drilled and etched PC board for this project is available for \$4.50 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

# Computer Control for Your Direct Digital Synthesis (DDS) VFO

*Free yourself of the hassles of generating an accurate and stable sinusoidal signal—and more!*

by Victor Morin VE1ABC

“Wow!” I exclaimed as I began reading John Welch N9JZW’s article “The Techno-Whizzy 1, Part I” (page 8 in the December 1992 issue of *73 Amateur Radio Today*). N9JZW’s article describes how to build a modular multiband CW low power (QRP) transmitter that uses a new Direct Digital Synthesis (DDS) chip. Why all the excitement? Read on!

Over the years I have constructed a number of home-built rigs (both receivers and transmitters) that have one thing in common: a variable frequency oscillator (VFO). Most receivers need VFOs to generate a local oscillator (LO) signal, and transmitters need them to be freed from crystal control of a single output frequency.

The VFO designs that I used in these projects were all tank-tuned with a combination of inductors (coils) and variable capacitors, either mechanical or varactor diodes. Those of you who have also gone this route know that there are certain inherent problems with this design: temperature drift, nonlinear tuning, difficulty in eliminating the mechanical backlash in the frequency-control element, frequency pulling when a load is placed on

the VFO, and the list goes on . . . For me, at least, this type of VFO design has been a royal pain!

I knew that there were alternatives, known as frequency synthesizers, to this traditional VFO construction and my interest focused on two general types: phase-locked loop and direct digital synthesis. Looking over some phase-locked loop synthesizer designs convinced me that it would probably be more of the same: LC tank circuits are used at very high frequencies and are varactor-controlled. Frequencies are regulated using phase detectors, thus generating phase noise, etc. Please don’t get me wrong—I’m not saying that phase-locked loop synthesizers should be avoided—I’m simply saying that for me they didn’t seem to be the way to go.

That left the direct digital synthesis approach. I read all I could on the topic and probably the best article I found is “A Direct Frequency Synthesizer” by Fred Williams in the April 1984 issue of *QST*. Surprised? This concept has been around for a long time! If you’re interested in the theory behind the direct digital synthesizer,

I highly recommend Mr. Williams’ article, in which he provides DDS theory and describes how to build a DDS using standard TTL IC chips, a read-only memory (ROM) and a digital-to-analog converter (DAC).

This is the exciting part. When I read the “Techno-Whizzy 1” article, I knew it was the answer to my dreams! You see, I had actually begun building the Williams DDS and was contemplating building a ROM burner for it when Techno-Whizzy came on the scene—and there was a full kit available. No more chasing after parts; no more burning bits into a ROM. I could get right down to business! I ordered the DDS right away, explaining to my wife that “it would be my Christmas present from me to me.”

## What’s So Great About a DDS?

A lot! Precise frequency control, frequency stability, no phase noise, the ability to change frequency very rapidly (frequency hop), etc. What’s the price you have to pay for all this? In a nutshell, you have to be able to provide the DDS with a digital (binary) value that is proportional to the frequency of the sinusoidal signal you want your DDS to generate. To me this meant computer control, although there are other means, as demonstrated in the Techno-Whizzy 1 article where a diode matrix and switches are used.

I own an IBM-compatible AT clone computer. While waiting for my DDS kit to be delivered in the mail, I decided to design and build a hardware interface that would control the DDS from my computer and, just as important, the software driver routine that would make the DDS perform as I wanted.

## The Design

I decided to use the printer interface port of my IBM-compatible to control the interface and I chose to use the simplest alternative in order to maximize my chances of success. That’s why I elected to use what is in fact a parallel port as a serial port! Why?

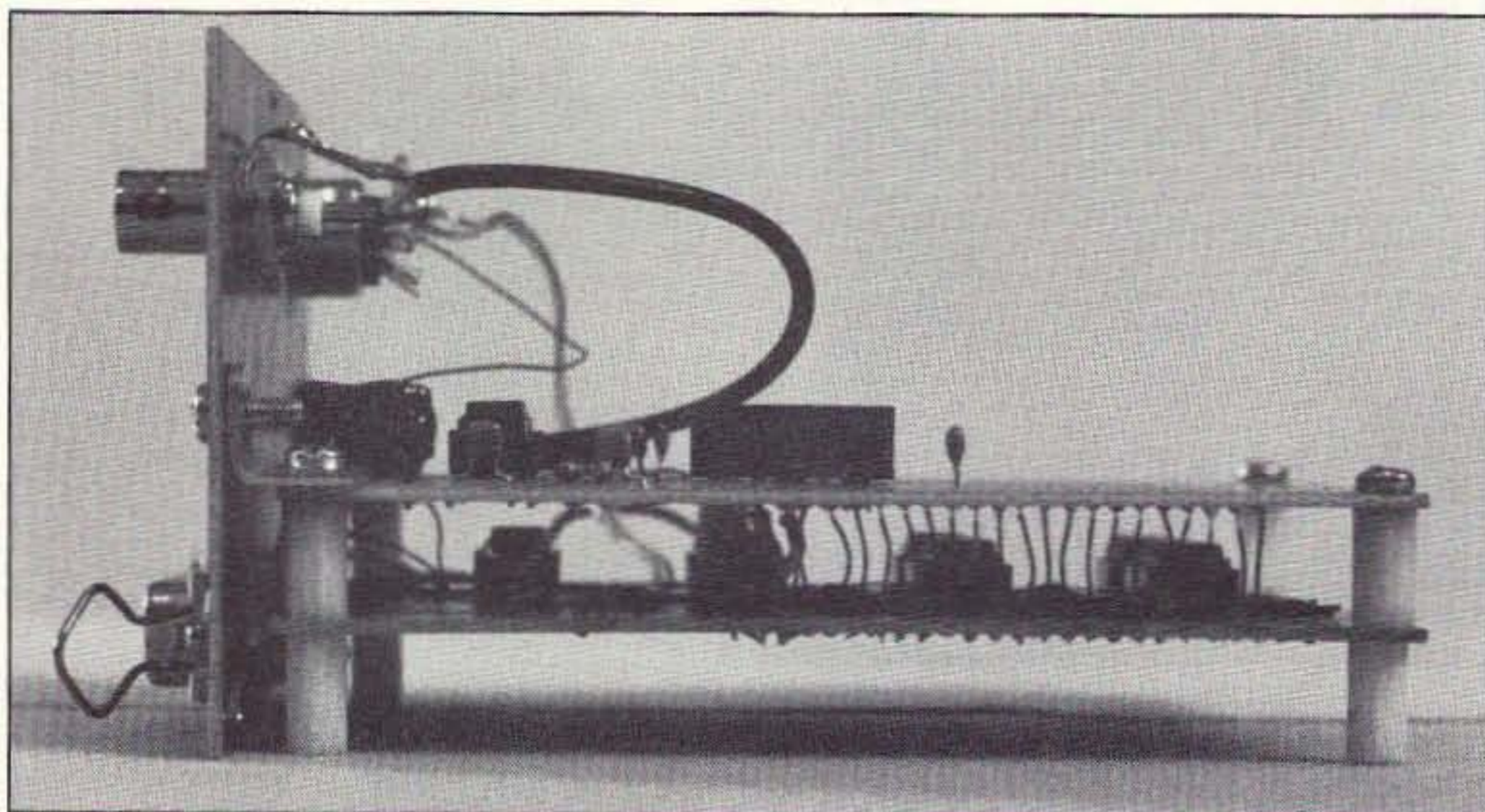


Photo A. The DDS is the top board. The interface is on the bottom.

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List price \$649.95/CE price \$339.95/SPECIAL  
**400 Channels • 20 Banks • Turbo Scan**  
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**Size: 2-3/4" Wide x 1-1/2" Deep x 7-1/2" High**  
**Frequency Coverage: 25.0000 - 549.9950, 760.0000 - 823.9950, 849.0125 - 868.9950, 894.0125 - 1,300.0000 MHz.**

Signal intelligence experts, public safety agencies and people with inquiring minds that want to know, have asked us for a world class *handheld* scanner that can intercept just about any radio transmission. The new Bearcat 2500XLT has what you want. You can program frequencies such as police, fire, emergency, race cars, marine, military aircraft, weather, and other broadcasts into 20 banks of 20 channels each. The new rotary tuner feature enables rapid and easy selection of channels and frequencies. With the AUTO STORE feature, you can automatically program any channel. You can also scan all 400 channels at 100 channels-per-second speed because the Bearcat 2500XLT has TURBO SCAN built-in. To make this scanner even better, the BC2500XLT has AUTO SORT - an automatic frequency sorting feature for faster scanning within each bank. Order your scanner from CEI.

For more information on Bearcat radio scanners or to join the Bearcat Radio Club, call Mr. Scanner at 1-800-423-1331. To order any Bearcat radio product from Communications Electronics Inc. call 1-800-USA-SCAN.

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- Bearcat BCT2-H info mobile ..... \$139.95

### New FCC Rules Mean Last Buying Opportunity for Radio Scanners

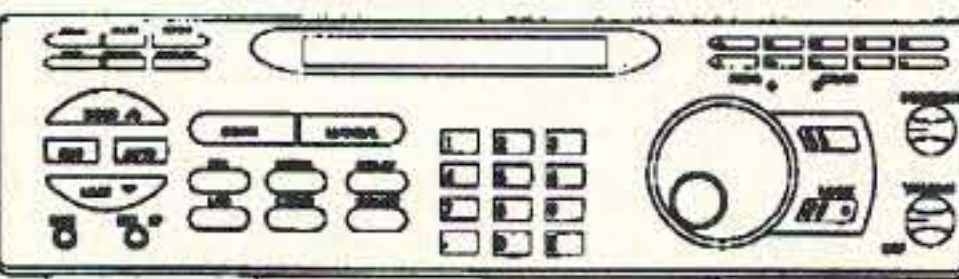
On April 19, 1993, the FCC amended Parts 2 and 15 of its rules to prohibit the manufacture and importation of scanning radios capable of intercepting the 800 MHz. cellular telephone service. Supplies of full coverage 800 MHz. scanners are in *very* short supply. If you need technical assistance or recommendations to locate a special scanner or solve a communications problem, call the Communications Electronics Inc. technical support hotline for \$2.00 per minute at 1-900-555-SCAN.

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**Size: 10-1/2" Wide x 7-1/2" Deep x 3-3/8" High**  
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25.000 - 28.995 MHz. (AM), 29.000 - 54.000 MHz. (NFM),  
 54.000 - 71.995 MHz. (WFM), 72.000 - 75.995 MHz. (NFM),  
 76.000 - 107.995 MHz. (WFM), 108.000 - 136.995 MHz. (AM)  
 137.000 - 173.995 MHz. (NFM), 174.000 - 215.995 MHz. (WFM),  
 216.000 - 224.995 MHz. (NFM), 225.000 - 399.995 MHz. (AM)  
 400.000 - 511.995 MHz. (NFM), 512.000 - 549.995 MHz. (WFM)  
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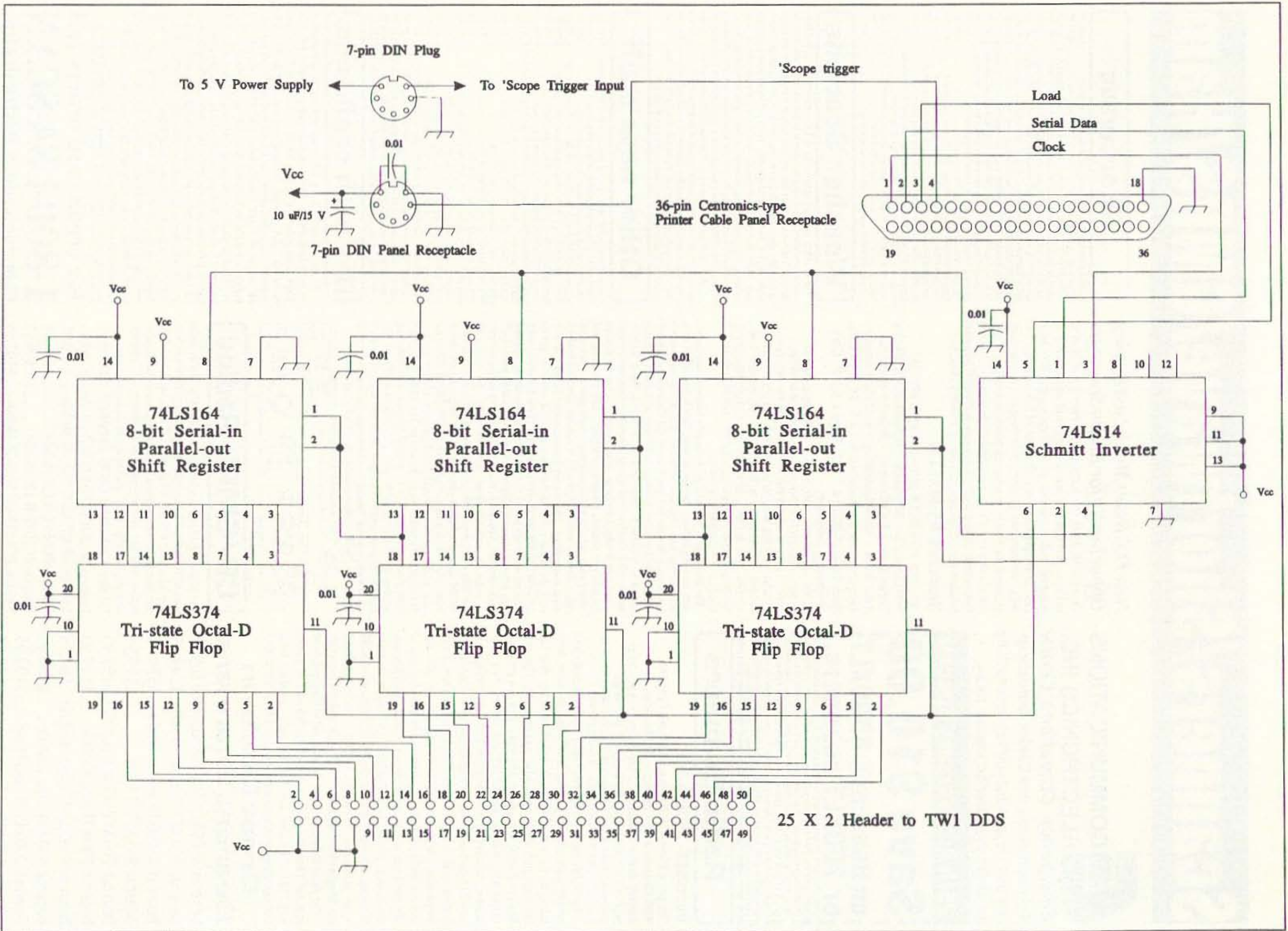
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Figure 1. Schematic for the TW1 DDS computer interface.



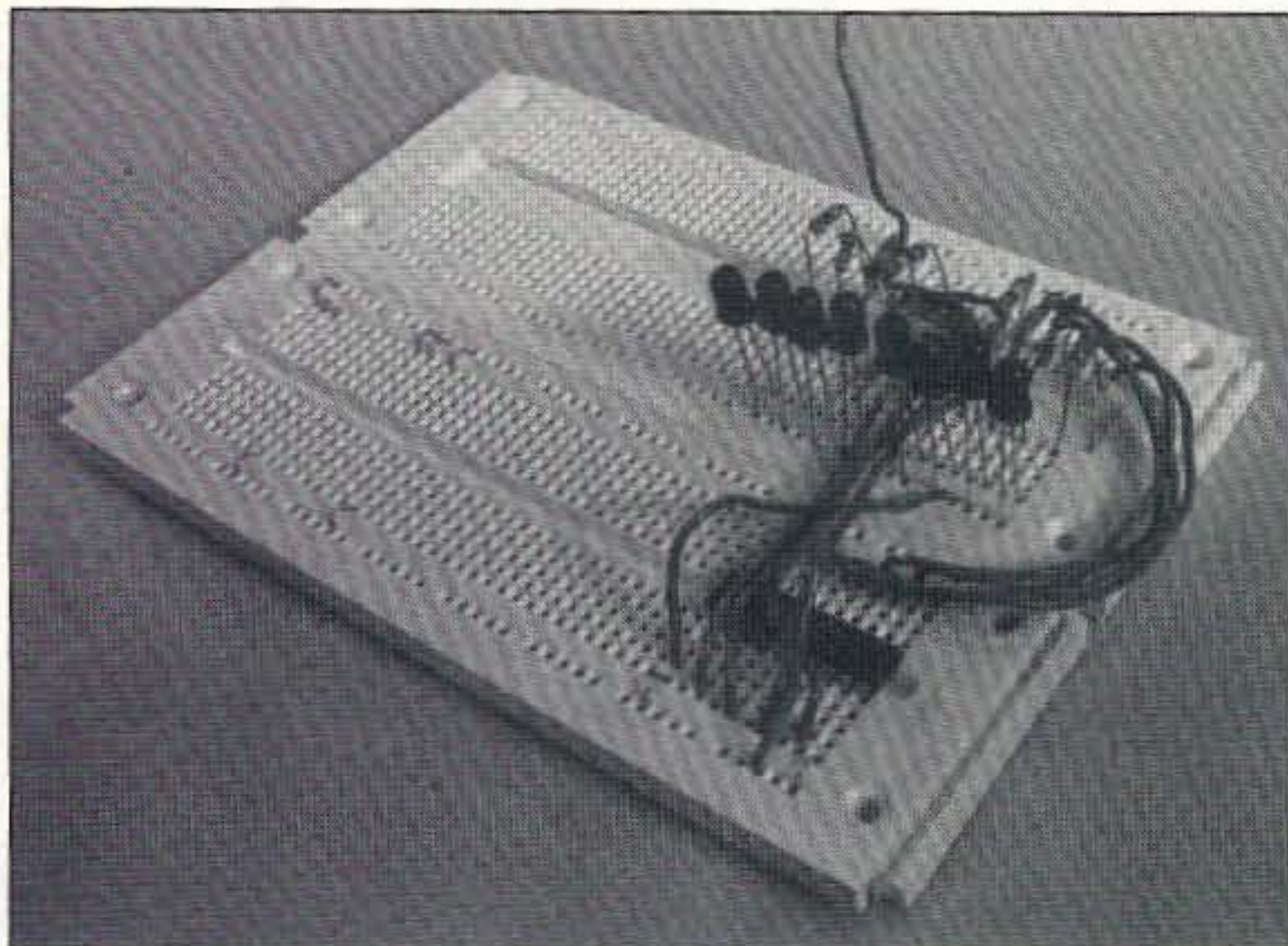


Photo B. The test jig.

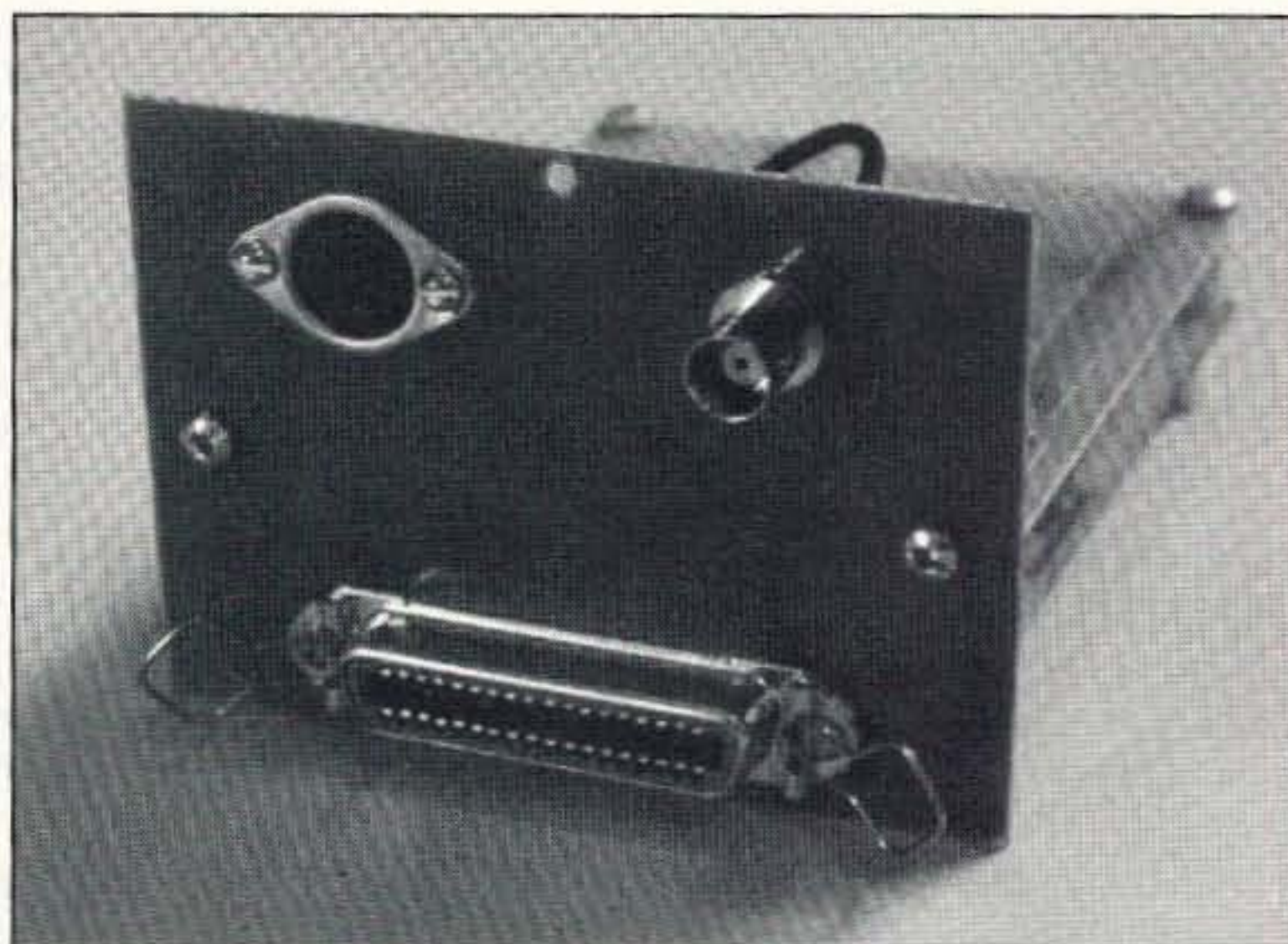


Photo C. The front panel.

Because I wanted to ensure that most of the computer output lines would not be used in solely controlling the interface (I may want to simultaneously control other devices with the computer in the future). I knew that the serial approach would slow down communications with the interface but I was willing to pay the price.

The software design was more complex

than the hardware. Here is what I wanted to be able to do:

a) Enter a decimal frequency value in the computer keyboard and have the DDS generate that particular frequency (0 Hz to 22 MHz with 3 Hz resolution);

b) Have the frequency go up or down by a particular increment whenever the operator presses the up-arrow key or the down-arrow key;

row key;

c) Scan a particular range of frequencies with the frequency increment determined by the operator, and scan in either triangle mode (scan up to the highest specified frequency and then suddenly return to the lowest specified frequency for another scan) or saw-toothed mode (scan up to the highest specified frequency and then, at the same frequency interval, return to the lowest specified frequency for another scan);

d) Generate a trigger signal for an oscilloscope at the beginning of each triangle mode sweep.

Thus, I wanted it all—a VFO plus a sweep generator with trigger output. An instrument that is accurate and stable, with its output variable from DC to approximately 22 MHz. Yes, you can use the DDS to generate audio frequencies. It's like having a very expensive lab-quality instrument at a very inexpensive price!

### The Hardware Interface

Figure 1 is a schematic of the hardware interface. It is straightforward and based on the Williams design. As expected, the computer software has to do all the work in driving the interface. Here is how it works: The computer generates a 23-bit binary number (representative of the frequency) that is to be presented to the DDS. This 23-bit number is sent to the DDS interface through the printer interface port and printer cable, bit by bit in serial fashion, beginning with the most-significant bit, on the serial data line. While the serial data bit is stable, the computer strobes the clock signal line, which accepts and shifts each data bit into three cascaded 74LS164 serial-in parallel-out shift registers. This is done 23 times, until all three shift registers have been loaded. The load line is then strobed, which presents the 23 bits, in parallel fashion, from the 74LS374 Tri-State Octal-D flip-flops to the DDS. The DDS then takes over and generates the required frequency. Piece of cake (sort of)! The trick is to generate the correct 23-bit binary number, and this is where the software provides all the functionality.

```

TW1 DDS Control

Key in frequency and press ENTER, or:

"*" To Change Frequency Increment
"↑" To Increase Frequency by Value of Frequency Increment
"↓" To Decrease Frequency by Value of Frequency Increment
"*" To Enter Scan Mode

Num Lock must always be ON, Caps Lock and Scroll Lock must always be OFF
otherwise the program does not run properly.

Press any key to continue...

```

Figure 2. The instruction screen.

```

TW1 DDS Control

Enter Frequency in Hz:      ?
Current Frequency in Hz:  3,686,400
Frequency Increment in Hz:  200

```

Figure 3. The control screen.

```

TW1 DDS Control

Enter Frequency in Hz:
Current Frequency in Hz:  6,240,000
Frequency Increment in Hz:  5,000

Scan Low Frequency in Hz:  5,000,000
Scan High Frequency in Hz:  6,500,000
Triangle (T) or Sawtooth (S):  T

Press Any Key to Start Scan Mode, "ENTER" to Exit Scan Mode

```

Figure 4. Scan mode for the DDS.

You will note that the load, serial data, and clock lines are "snapped up" through a 74LS14 Schmidt inverter to ensure that the leading and trailing edges of the pulses are sharply defined and jitter-free. Because the serial data pulses are inverted as a result, the software generates the 1's complement of the required 23-bit data word (every bit is "flipped"—i.e. a 1 becomes a 0 and a 0 becomes a 1).

### The Software Driver Routine

The only software-generating tool available to me was Microsoft QBASIC so I didn't have much choice! I've annotated almost every line of code in the DDS.BAS program to give you an idea of what is going on in case you'd like to change things and experiment.

The mainline section of the routine begins with the usual housekeeping chores, after which the instruction screen is drawn (Figure 2). An initial frequency is sent to the DDS (I chose 0 Hz but you can change this to any frequency you like). Figure 3 shows the layout of the control screen. Two subroutines are used to generate the required 23-bit data word that is sent to the DDS—ConvertToBinary and SerialToParallel.

ConvertToBinary accepts a decimal frequency value and converts it to binary in 1's complement form (see above). It uses the age-old venerable "divide-by-two" algorithm that you may have learned in school to convert from the decimal system to binary notation.

SerialToParallel performs three chores: It scales the frequency value, calls ConvertToBinary, and pumps out the 23-bit data word to the DDS interface. Why scale the frequency value? Without going into a lot of technical details, the DDS will generate a frequency that depends not only on the 23-bit data word that is presented to it but also on its on-board clock frequency. The on-board clock chip that comes with the DDS kit has a frequency of 55 MHz, and what you have to do is scale the frequency value so that the DDS will generate the exact corresponding frequency.

Back to the mainline section of the routine. The computer sits there and waits for you to do one of a number of things:

Press the "+" key. This selects the next frequency-increment value that is contained in the frequency increment table in round-robin fashion (i.e. you return to the first frequency increment after having gone past the last). The frequency-increment value determines how much the frequency will jump when you press the up-arrow key, the down-arrow key, or while you are in scanning mode (see below).

Enter a frequency and press the enter key. The DDS generates the corresponding frequency.

Scan mode (Figure 4). Enter a scan-low frequency, a scan-high frequency and determine whether you want a saw-toothed scan or a triangle scan. The DDS generates frequencies beginning at the scan-low frequen-

cy, jumping by the frequency-increment value (see above). When the scan-high frequency is reached, the DDS either jumps back to the scan-low frequency (triangle mode) or proceeds downward, at the same rate, toward the scan-low frequency (saw-toothed mode). At the beginning of each triangle-mode cycle, a scope trigger signal is generated in case you'd like to trigger the sweep of your scope externally. The whole thing happens over and over until you decide to exit scan mode.

Press either the up-arrow key or the down-arrow key and the frequency will change upward or downward, depending on the key you pressed, by a value correspond-

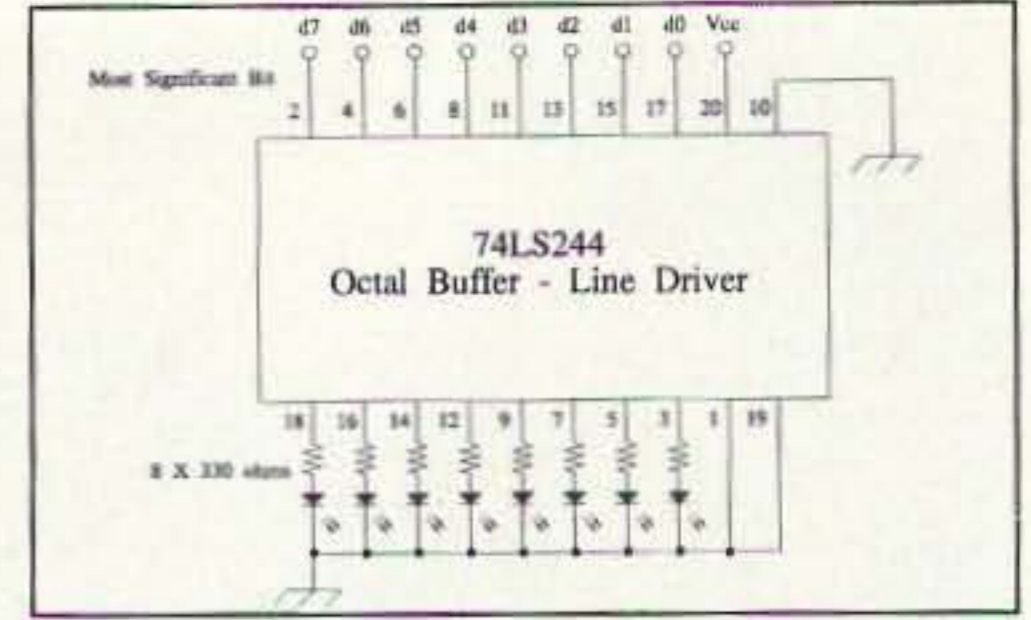


Figure 5. DDS computer interface test jig.

ing to frequency-increment. Hold your finger down on either key and the DDS will

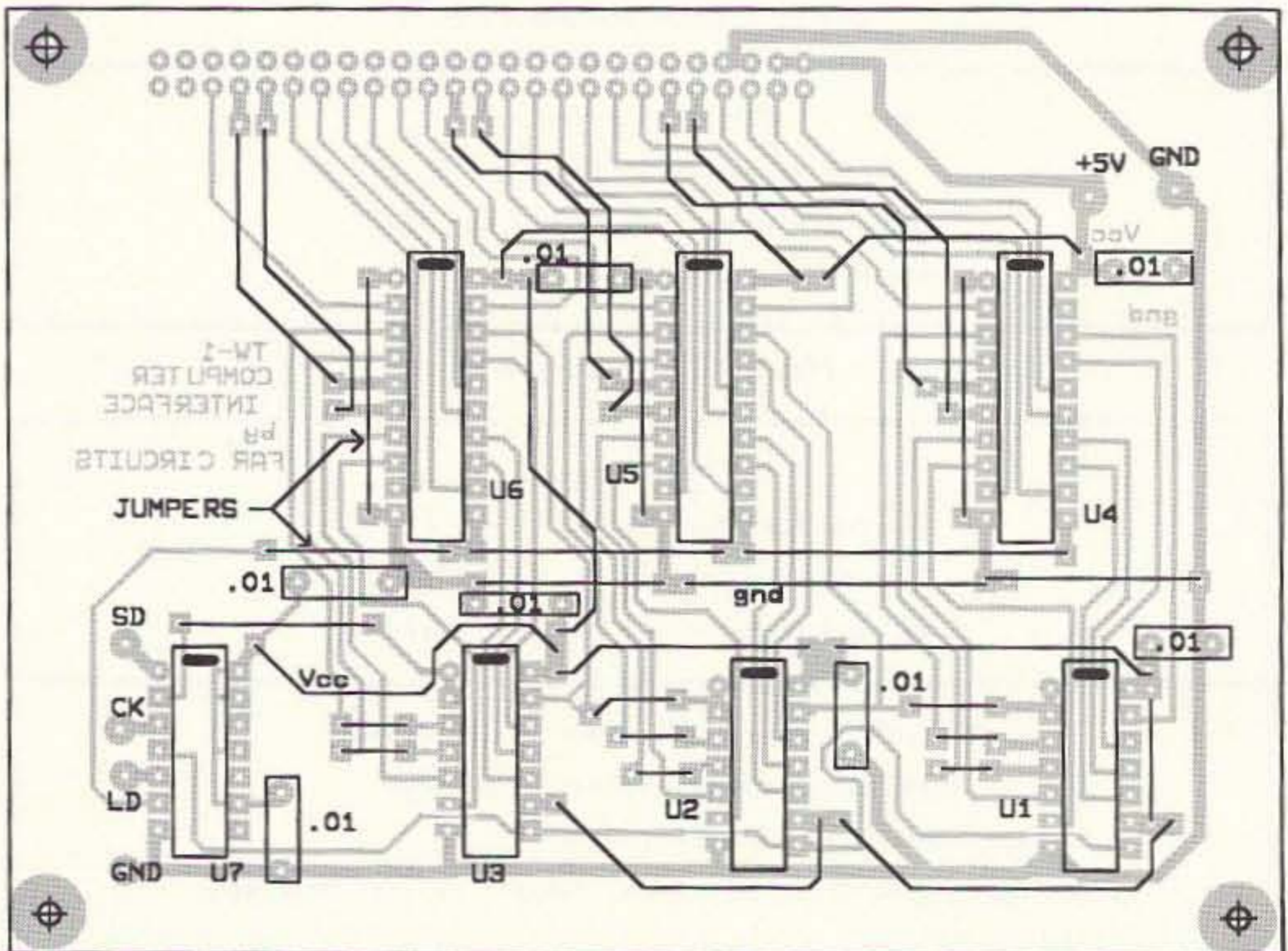
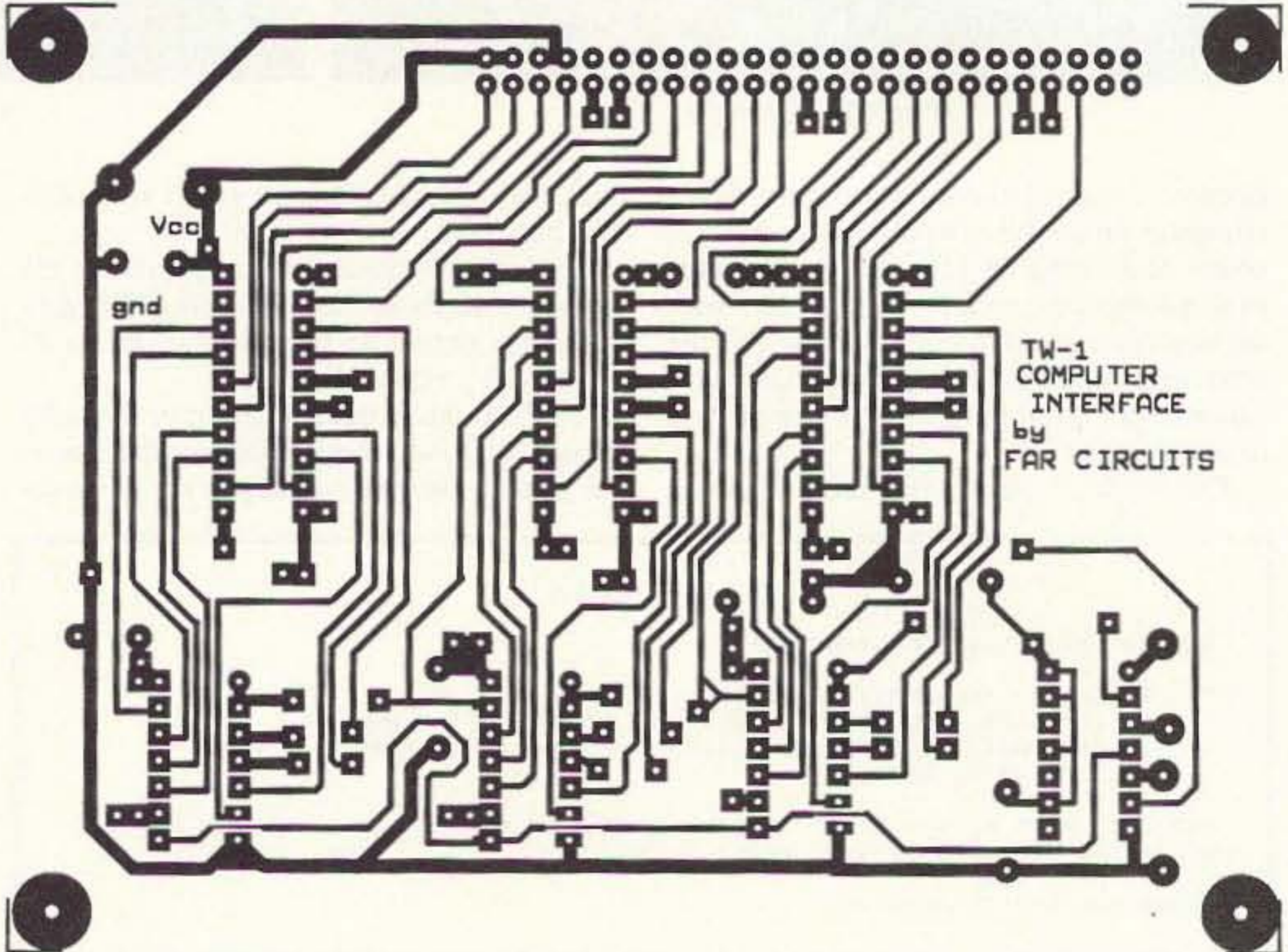


Figure 6. PC board pattern and parts placement diagram.



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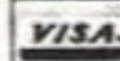
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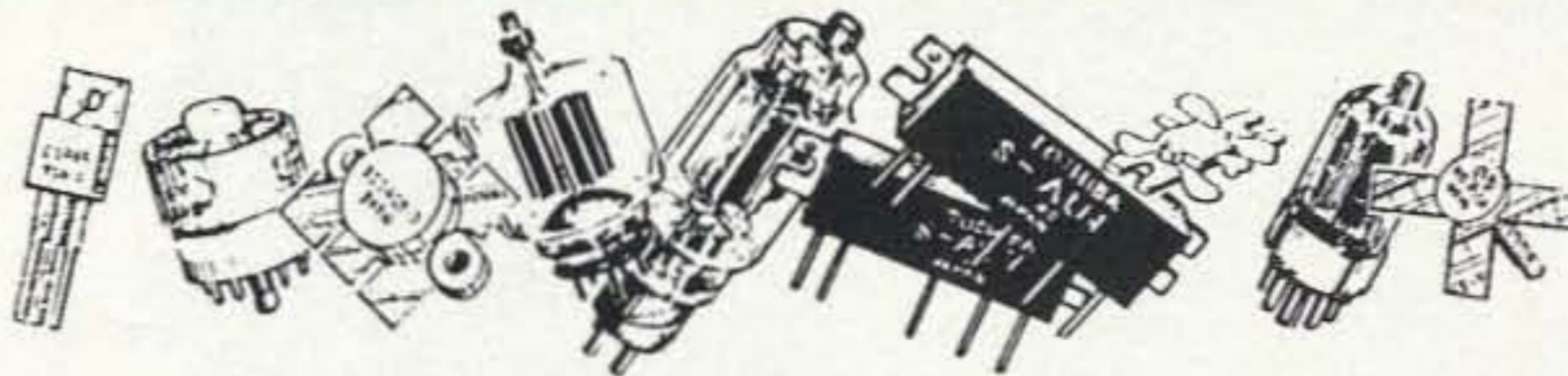
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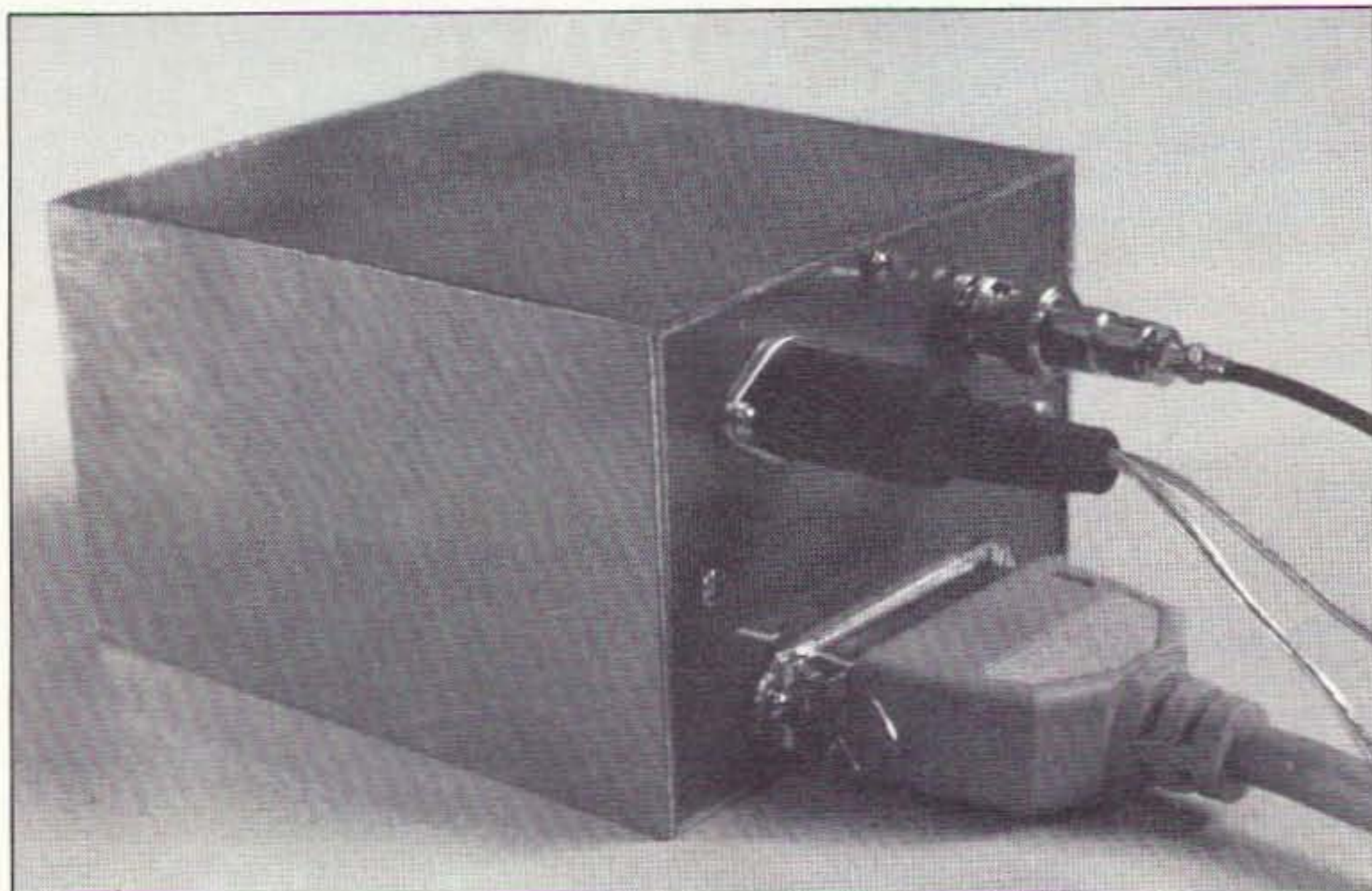


Photo D. The completed unit in its enclosure.

scan up or down as long as the key is pressed.

#### Construction

I decided to build the prototype interface on a printed circuit board that is exactly the same size as the TW1 DDS. This would afford a couple of advantages: The DDS

board could be mounted on top of the interface board or vice versa, and the 25 X 2 headers could be made to line up exactly one on top of the other. I would simply wire one header to the other, ladder fashion and each wire perpendicular to the boards (Photo A).

Because my skills at designing and build-

ing two-sided printed circuit board are limited (non-existent would be a better choice of words), I built a one-sided board where most of the signal lines would be interconnected using 30-gauge insulated wire. If you choose to go this route, be prepared for a lot of drilling and a lot of precise soldering! Perhaps a better way to go would be to use a drilled and etched PC board available for \$6.50 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

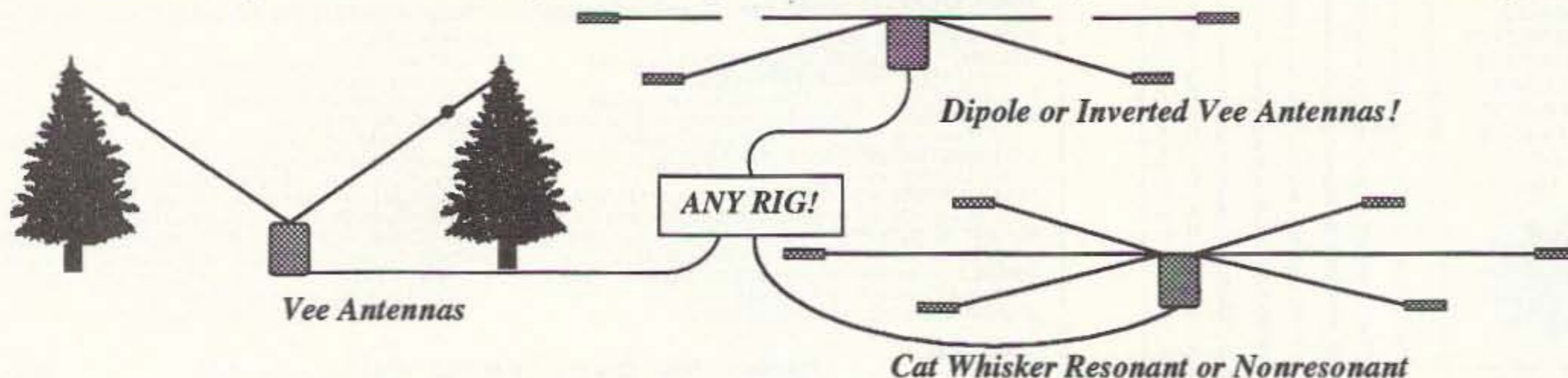
If you decide to make your own board, first etch the printed circuit and drill all the required holes. Install IC sockets! This will help you immensely if you have problems and have to troubleshoot in the future. Interconnect all the signal lines using Figure 1 as a guide. Install the 0.01 bypass capacitors as well as the 10  $\mu$ F electrolytic capacitor. Don't put in the IC chips in their sockets yet! Check each and every interconnection with an ohmmeter looking for "opens" and pin-to-pin shorts. Only proceed to the next step once you are satisfied that the assembled printed circuit board checks out perfectly!

#### Check-Out

Temporarily connect the clock, serial data, and load signal lines to pins 1, 2, and 3 of the 36-pin Centronics-style printer cable panel receptacle. Temporarily connect a wire from pin 18 of the printer cable recep-

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tacle to a suitable grounding point on the interface board. Plug the printer end of your printer cable (36-pin) into the receptacle leaving the other end (25-pin) unconnected from the parallel port of your computer. Check for the following continuity: pin 1 of the printer cable (25-pin end) with pin 3 of the 74LS14 chip, pin 2 of the printer cable (25-pin end) with pin 1 of the 74LS14 chip, pin 3 of the printer cable (25-pin end) with pin 5 of the 74LS14 chip, pin 18 of the printer cable (25-pin end) with ground on the interface board. Don't proceed any further unless you are convinced that the above checks out.

Next, load the DDS.BAS program into your computer. Access the SerialToParallel subroutine and disable the HoldFreq& = CLNG(CDBL(Freq&) \* .3050398#) line by commenting it out with a single apostrophe at the beginning of the line. This disables scaling for the time being. Enable the statement immediately after the line that you have just disabled (HoldFreq& = Freq&). To provide display of the 23-bit data word on your monitor screen, access the ConvertToBinary subroutine and enable the following line:

```
LOCATE 23,1: FOR i% = 22 TO 0 STEP -1: PRINT BinaryValue(i%);:NEXT i%.
```

This causes the 23-bit word to be displayed in binary at the bottom of the screen.

Remember that this is the 1's complement of the number entered, however.

You are now going to check out your unit by using eight LEDs to ensure the correct bit pattern is being generated by the interface. (You could use 23 LEDs at once, if you like). Build a test jig based on Figure 5. I used an IC proto board because the test jig is only used once for check-out purposes (Photo B). Temporarily connect the eight test jig inputs to the eight least-significant-bit outputs of the interface (outputs 32 to 46 to inputs d7 to d0).

Populate your printed circuit board with its ICs. Connect the computer printer cable to the parallel port on the printer. Provide 5 volts to the interface board and the test jig. Run the DDS.BAS routine and key in a frequency of zero Hz. All eight LEDs on the test jig should be out. All the bits at the bottom of the screen should be 1s. Now key in a frequency of 255 Hz. The inverse should happen and all eight LEDs should be lit, the eight least significant bits on the screen should all be 0s.

Next, unsolder the eight test jig inputs and temporarily solder them to outputs 16 to 30 of the interface (30 to d0, 28 to d1, etc.). Key in a frequency of 65,536 Hz. All eight LEDs should be lit. Key in a frequency of zero Hz. All eight LEDs should be out. Enter other values to see the generated bit pat-

terns.

Finally, disconnect the input leads to the test jig and re-connect the seven least significant test-jig inputs to the seven most-significant-bit outputs of the interface (2 to d6, 4 to d5, etc.) Leave d7 unconnected and ignore the left-most LED. Key in a frequency of zero Hz. All seven LEDs should be out. Key in a frequency of 8,388,607 Hz. All seven LEDs should be lit. You will notice that the bits displayed at the bottom of the screen always show the inverse of the bits represented by the LEDs.

If things don't check out, the particular bit(s) that is (are) not functioning properly will give you a hint as to where the trouble might be on the interface. Use your analytical skills to zero in and determine where the problem lies. Once everything is OK, disconnect the test jig.

### Final Assembly

I assume that you've constructed and checked out your TW1 DDS board before proceeding to this point. Mount the DDS board on top of the interface board using half-inch threaded spacers (photo A). Solder the 23 signal lines (outputs 2 to 46) from the interface board to the DDS board and check the continuity of the 23 lines from one board to the other. Use 22 gauge hook-up wire to provide Vcc and ground to the DDS



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board. Next, attach the combined units, using two small-angle brackets, to a front panel. My front panel holds a seven-pin DIN round receptacle, a 36-pin Centronics-type printer cable receptacle, and a BNC single-hole-mount chassis jack (Photo C). Solder the three signal wires leading from the printer cable receptacle to the interface board. I use the seven-pin DIN receptacle to provide power to the unit and to provide the scope trigger signal to the outside world. Solder the scope trigger line from pin 4 of the printer cable receptacle to an unused pin on the DIN receptacle. Connect the BNC jack to the DDS output with a short length of miniature 50 ohm cable. You may wish to build an enclosure for the unit in order to provide shielding. I built mine using double-sided printed-circuit board (Photo D).

### Calibration

Calibration? But there aren't any trimmer capacitors! Do you remember the scaling factor in the software routine that I mentioned earlier? Well, it's now time to "tweak" the scaling factor to your on-board DDS clock. Go back to the DDS.BAS program and disable the program lines that you used for checkout purposes. Also remove the single apostrophe in front of the following line: `HoldFreq& = CLNG(CD-BL(Freq&) * .3050398#)`. Now connect a frequency counter to the output of the DDS, connect the unit to a 5 volt power supply, connect the printer cable between your computer and the DDS, and fire everything up. Begin by keying frequencies that are multiples of 1 MHz and observe the values on the frequency counter. If you have an oscilloscope, you may also want to view the purity of your sinusoidal signal. Assuming there are no problems in your soldering and wiring job, you should get frequencies that are close to those being keyed in and that have a very high degree

### Parts Information

A copy of the DDS.BAS driver routine software written in QBASIC can be downloaded free from the 73 BBS at (603) 924-9343.

The DDS VFO module kit is available from Elkronics, 12536 T.R. 77, Findlay OH 45840; (419) 422-8206.

The receptacles, capacitors, IC chips and sockets for the computer interface are all available from Digi-Key at (800) 344-4539, or from other major distributors.

The eight LEDs used in the test jig can be any LEDs that you have in your junk box.

The use of a manufactured computer cable is not mandatory—you can build your own cable using receptacles of your choice.

Drilled and etched PC boards are available for \$6.50 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

of purity. Once you've gone up to 22 MHz and everything looks OK, play with the unit by entering oddball frequencies. The DDS should react accordingly and this should be reflected on your frequency counter.

The adjustment of the scaling factor should now be obvious. If your input frequency is consistently high compared to the frequency counter, reduce the scaling factor, and vice versa. By how much? I don't know. I just did mine by trial and error until the frequency counter read dead-on and then I built a direct conversion receiver using the DDS as the LO to zero-beat it against WWV. I think the accuracy of my unit is within 50 Hz, if not better.

### Operation

I tried to make operation of the unit as intuitive as possible and I hope that the instruction screen (Figure 2) is self-explanatory. Those of you who are accustomed to Windows-based applications won't find this very fancy but, in my defense, all I can say is that the proof is in the pudding. Speaking of Windows, you will find that the scanning process is slowed if the software is run in a Windows environment. If you want maximum scanning speed from your

computer, run DDS.BAS in an MS-DOS environment.

### What Next?

I encourage those of you who are interested in software design to combine forces with the hardware types, and vice versa. The software that I have developed is first-generation and I have placed it in the public domain. Play with it. Change it for the better! A machine-language routine to speed up the scanning process might be interesting. The hardware interface is nothing fancy. How about someone developing a true parallel interface, or using adder chips on the interface board again to speed up the scanning process? How about frequency hopping or spread-spectrum applications? The sky's the limit!

As for me, I'm going to continue my quest for the Holy Grail: building an up-converting general-coverage HF receiver (with FM, of course) using the TW1 DDS as one of the fundamental building blocks. Hmm . . . I wonder if cheap HF crystals can be used at their third overtone to build a ladder filter at approximately 45 MHz? The TW1 DDS in scanning mode, heterodyned to VHF, will help me find out. I hope I have as much success with that project as I did with this one. 73

## Bench notes from John Welch N9JZW, designer of the TW-1 DDS rig.

Since I built the TW-1, people have been asking me why I didn't make it computer-controllable. Frankly, I didn't want to, given my other plans for expansion. However, there *is* a need, and this board fills it well.

I built the project on a PC board, which is shown in the adjacent photo. It went together smoothly, taking about an evening's work to assemble. There are a lot of jumpers, but they are plainly marked and should cause you little trouble. Do socket all the chips, as I had one bad chip which kept mine from working the first time. A quick change took care of that, though, and it has worked since then.

Be careful about soldering, and make sure you have the chips inserted the right way. The parallel port on an IBM PC isn't protected, and it is possible to blow up a chip if you get some wires crossed. Just be sure to double-check your wiring, as the article says.

The program will only work if you use a parallel port at address 3F8 (hex). The port on an old monochrome video board is *not* at this address, but for most computers this is LPT1 and should cause no problem.

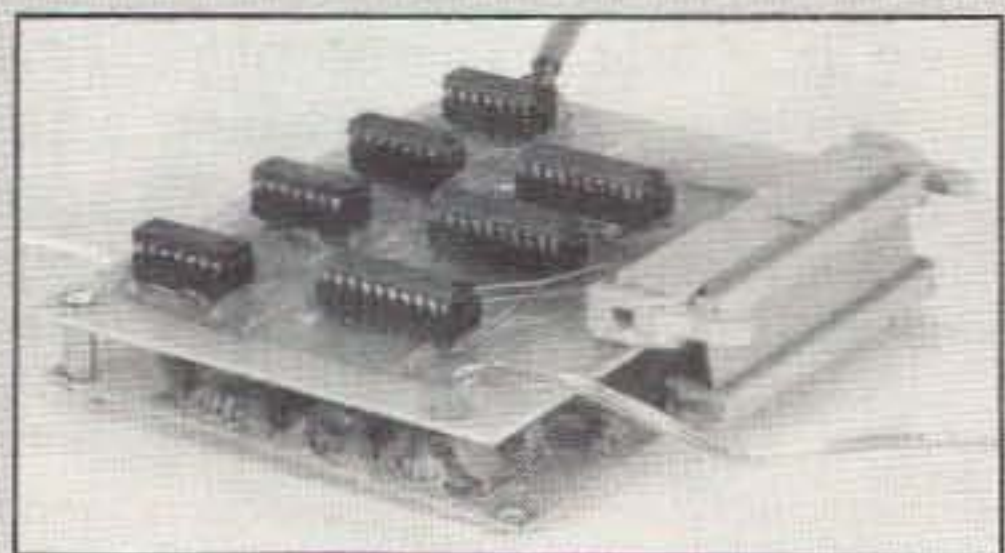
There is an easier and faster way to calibrate the frequency. You'll need a calculator and a frequency counter that can handle 55 MHz signals. Measure the frequency of your TW-1's oscillator (it's available on the jumper on the DDS VFO board). The "fudge factor" should be  $16777216 / (\text{your oscillator frequency in hertz})$ .

My oscillator runs at 55000230 Hz, so my value is  $16777216 / 55000230 = 0.3050390153$ . This should put you dead on frequency the first time you run the program.

If you don't have a frequency counter, don't worry—the 55 MHz oscillators are very accurate and stable, and you'll be no more than about 50 Hz away from where you think you are over almost all bands.

There is an enhancement I'm working on for the TW-1 that will increase your upper range from 21.5 MHz to slightly over 30 MHz. This will require a small change to the program, and another jumper to be added to this board. FAR Circuits is adding a pad on pin 48 of the header for this.

When I get this board functional, I'll also let you know what to jumper and what to change in the program. 'Til then, hope you have fun with your TW-1 Direct Digital Synthesized rig. 73 de N9JZW. 73



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# ASCII-to-Morse-Code Interface

*Let your keyboard do the work.*

by Steven Weber KD1JV

Do you have a computer in your shack and only use it to log QSOs, send packet or play games? This simple weekend project will allow you to send and receive Morse code with your computer as well. It will not decode Morse code for you (that's cheating!), but your fingers will never have to leave the keyboard.

## Packed Full of Features!

The ASCII-to-Morse-code Interface (or A.M.C.I.) will convert ASCII characters into Morse code at the speeds of 10, 13, 15, 17 or 20 wpm, as selected from the keyboard. It has a 30-character input buffer, a message memory of 50 characters and it even has a built-in electronic keyer function so you can use your paddle instead of the keyboard, should you desire.

## Operation

When first powered up, the A.M.C.I. generates a short beep and outputs the message **\*\*\*RECEIVE\*\*\*** to your computer screen. It is now in the receive echo mode. Whatever you type on your keyboard will be echoed back to the screen.

When you type the character "+" the A.M.C.I. switches into the transmit mode and outputs the message **\*\*\*TRANSMIT\*\*\*10 WPM\*\*\*** to the screen. What you now type is echoed back to the screen and then converted into Morse code. The A.M.C.I. recognizes letters (upper or lower case), the numbers 0-9, and the punctuation marks: period, comma, dash, and question mark. Any character not in the Morse look-up table will simply be echoed back to the screen. The code speed is selected with the characters # (10 wpm), \$ (13 wpm), % (15 wpm), ^ (17 wpm) and & (20 wpm). The selected speed is output to the screen as a message, i.e. **\*\*\*17 WPM\*\*\***. The speed can be changed at any time in the transmit mode. Typing "[" doubles the spacing between letters and words. Typing "]" returns the spacing to normal. This provides an easy way of slowing down the code speed when necessary because of QRM. The character "!" toggles the A.M.C.I. back into the receive mode. The ENTER key generates a carriage return and line-feed response to the screen. The space key will generate the proper inter-word spacing.

You may want to make a tem-

plate for your keyboard to label the function keys until you've got them down pat.

The A.M.C.I. has a 30-character input buffer. The characters are echoed back to the screen as you type. If you are a good typist there is a possibility you will fill up the buffer. The A.M.C.I. will not allow you to overwrite the buffer. Your computer's bell will sound if the buffer is full, informing you to stop typing for a minute and let the buffer send out some characters. It is best to type only a few words ahead and then pause for a few moments before continuing.

## Message Storage

The A.M.C.I. can store a message of up to 50 characters in length. Spaces count as characters. Typically you would use this to store a "CQ" message, but of course you can put whatever you want there. To store a message, type "\*." The message **TYPE MESSAGE 50 CHRS MAX** will then appear on your screen. Now type in your message. Mistakes can be corrected by using the backspace key. If you enter in too many characters, the message **\*\*\*BUFFER FULL\*\*\*** will appear on the screen and return you back to the "type message" message. Enter a "!" as your last character. The A.M.C.I. will then respond with the message **\*\*\* END OF MESSAGE\*\*\*** to the screen and exit back to the receive mode.

To output the message, enter "@." The A.M.C.I. will now output the message at the code speed currently selected. The characters of the message are written back to the screen one at a time as they are sent. You

can send the message in either the receive mode or the transmit mode and you will return to the mode that you were in when the message output was selected. This allows you to send the CQ message while in the receive mode and return there automatically to copy an answering call. Or you can use the message to send your name and QTH while in the transmit mode and then continue sending when the message is finished.

## The Electronic Keyer Function

The electronic keyer is active at all times in the transmit mode. Its speed is the same as that currently selected from the keyboard. It has dot and dash memory, sensed at the end of the dot or dash and before the space. This makes for glitch-free operation. If both paddles are squeezed together at the same time it will send a dot-dash string that starts with whatever made contact first, the dot or the dash.

As an option you can add an N.O. push-button switch and five LEDs on your front panel. If you hold in the PB switch (which I labeled "KYR SPD"), then turn the power on, you will now be in a stand-alone keyer mode. This allows you to use the keyer function without having to turn on your computer first.

The LEDs indicate the speed that the keyer is set to. Pushing the PB momentarily will advance the keyer speed. This function operates only in the stand-alone keyer mode, but the LEDs will also indicate the speed that the A.M.C.I. is set to during normal keyboard operation.

CPU port bit P1.4 (pin 5) is set low in the stand-alone mode. You can add another LED (with a 330 ohm series resistor) to the front panel to indicate this mode if you want to.

## The Circuit

The heart of the A.M.C.I. is an 8031 microcontroller. The 8031 has been an industry standard for some time now and is still used in many products. The 8031 is an 8-bit device that has a built-in serial port, 128 bytes of internal user RAM, 128 bytes of internal function registers, two timers, a Boolean processor, 16 I/O ports, and can address up to 64K of program memory and 64K of external RAM. The instruction set is designed so that the program code is very efficient. The program for this project is a little over 1.5K

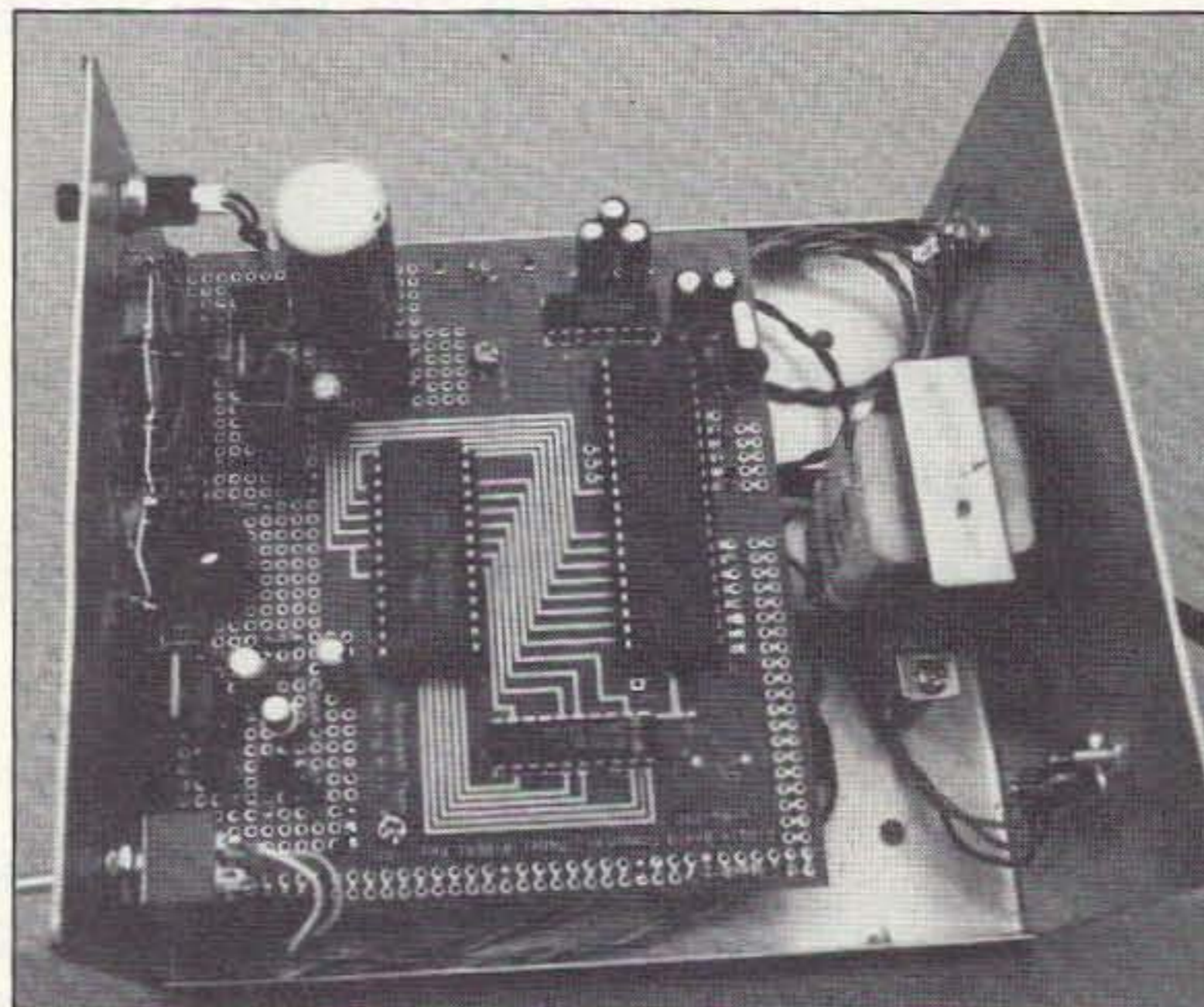


Photo A. Under the hood of the A.M.C.I.



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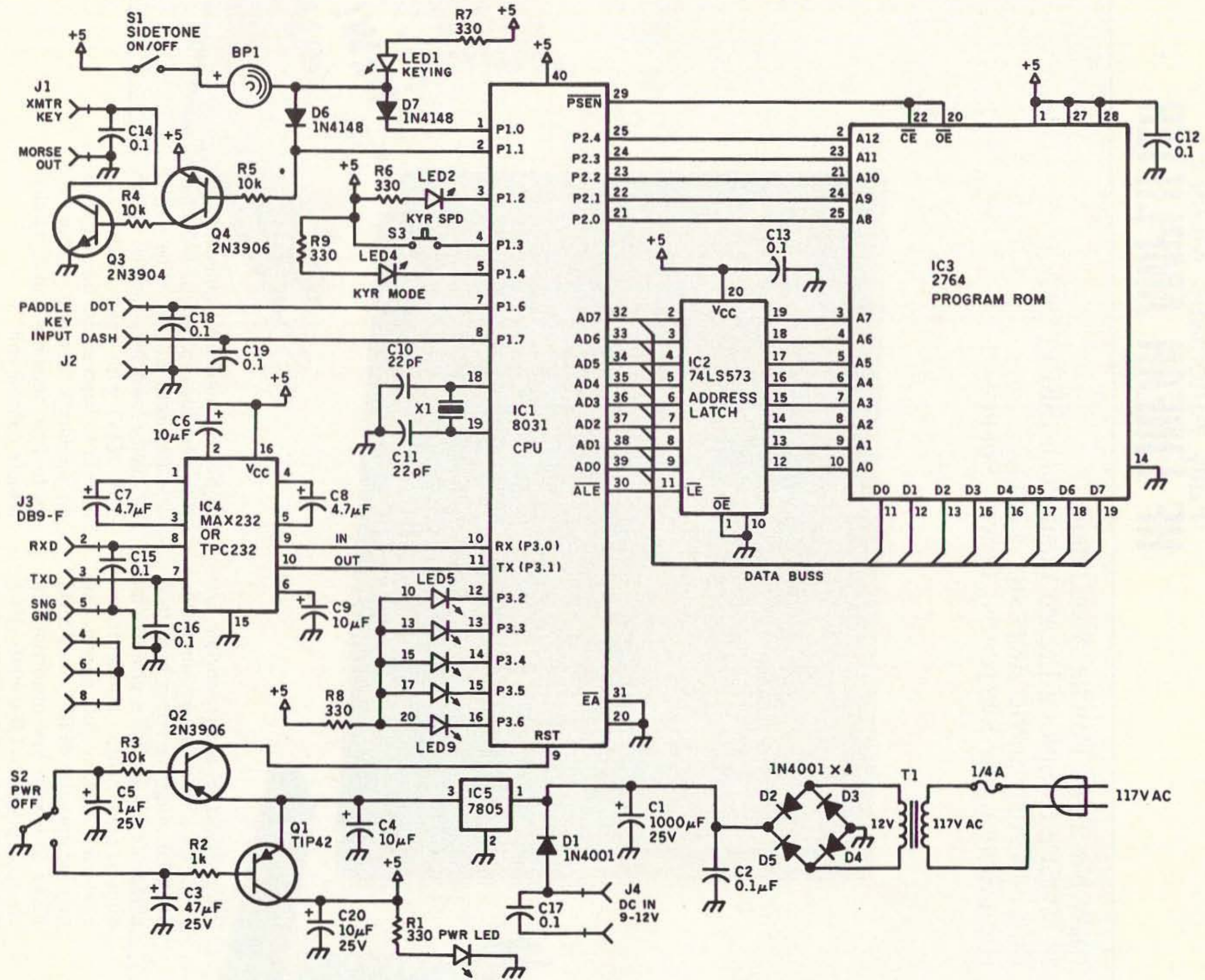
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Figure 1. Schematic for ASCII-to-Morse Code interface.





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- Very Compact -- just 3 1/2 x 9 x 15 inches -- fits in nearly any mobile installation; weighs only 7 pounds, that's less than some mobile HF transceivers
- Extremely quiet -- quiet low speed, low volume fan stays off and silent until temperature rises
- Output Power -- 600 Watts PEP, 400 Watts CW
- Continuous Coverage -- 1.5 to 22 MHz; 10/12 Meters with easy-to-install optional kit
- Load Fault Protection -- disables and bypasses amplifier if antenna has excessively high reflected power or if bandswitch is set lower than exciter frequency -- virtually eliminates damage because of operating error; has Load Fault LED indicator
- Thermal Overload Protection -- disables and bypasses

Exact power output of amplifiers may vary on each band.

amplifier if temperature is excessively high; automatically resets when temperature drops to safe level; has Thermal Overload LED indicator

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Photo B. The completed project.

piezo beeper, a number of LEDs and transmitter keying transistors complete the circuit. The keying circuit is designed for solid-state rigs. If you have a tube transmitter, try using an optoisolator to drive a high voltage power transistor, or add a relay to key your rig.

The power supply for the A.M.C.I. is on all the time. Power to the main circuits is turned on and off using

a simple PNP transistor switch. When power is turned off, another PNP transistor is turned on to supply power to the RST pin of the CPU. This keeps the internal RAM alive so that your stored message doesn't have to be entered every time the unit is turned on. The capacitors C3 and C6 keep their associated transistor turned on when the power switch is thrown long enough to ensure proper power down, power up reset of the CPU.

If you don't mind entering the message every time you turn the unit on, these parts can be eliminated and the AC line switched on and off. If you go this way, a 2.2  $\mu$ F cap

must be installed between +5 and pin 9 (reset) on the CPU.

### Communicating to the Interface

The serial port of the A.M.C.I. is set to 1200 baud, 8 bits, no parity and 2 stop bits (1200,8,N,2) and it recognizes standard ASCII. To talk to the A.M.C.I. you must have a communications program of one sort or another installed in your computer. The TELECOM program that came with my TANDY laptop works just fine. Other programs such as PC TALK, PROCOM, and the like will also work. As long as you can make a direct connection to your serial comm port you will be all set. By using one of these communications programs you can also save your QSOs as a file on disk or floppy. For those of you who don't already have a communications program, a public domain program that emulates a dumb terminal will be supplied along with the source code for this project.

### Construction

There are three ways you can build this project:

First, you can "prototype it" using the perf board and wire wrap method.

Second, you can buy an SBC (Single Board Computer) kit from Suncoast Technologies (see the Parts List). The kit comes

bytes long, much of which is the Morse look-up table and ASCII jump table.

The 8031 multiplexes the lower eight address bits out on the data bus. A 74LS573 is used to latch this address information. A MAX 232 IC (or TPC232) is used to interface the RS-232 input and output to the 8031 serial port. The MAX 232 has a built-in voltage doubler and inverter to generate the +10 and -10 volts required by RS-232 ports. The CPU's clock is 11.0592 MHz. This frequency was chosen by the 8031 developers so that standard baud rates can be easily generated with the 8031's internal timers.

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with the basic computer parts, i.e. CPU, latch, RS232 chip, crystal, caps, sockets, and PC board. The PC board has enough room on it to mount the power supply and I/O parts. Also, as a bonus, you get a disk with all the programs you need to write your own 8031 programs. That is how this project was developed.

Finally, you can use the PC board designed for this project. The board is single-sided, making it possible to home-brew should you desire. All the parts can be found between JDR Microdevices and Radio Shack.

Please note that IC2 and IC3 have pin 1 facing "down" and that there are 16 wire jumpers on the board. Use #24 stranded wire to connect the various switches and jacks to the board. If possible, use 1/8 watt resistors as they will fit the board better than 1/4 watt.

### Summary of Keyboard Commands

+	Go to transmit
!	Go to receive
*	Enter message mode
@	Transmit message
#	Set 10 wpm speed
\$	Set 13 wpm speed
%	Set 15 wpm speed
^	Set 17 wpm speed
&	Set 20 wpm speed
[	Doubles code spacing
]	Resets to normal spacing

### Parts List

* IC1	8031	8-bit controller
* IC2	74LS573	Octal bus latch
* IC3	2764	8K EPROM
* IC4	MAX232 or TPC232	RS232 interface
* IC5	7805	5V-to-220 voltage regulator
	Heat sink for regulator	
Q1	TIP42	TO-220 PNP power transistor
Q2,4	2N3906	PNP small signal transistor
Q3	2N3904	NPN small signal transistor
D1-5	IN4001	1 amp rectifier diodes
LED 1-9	Red LED	
D6,7	1N4148	Small signal silicon diode
* XTAL	11.0592 MHz	Microprocessor clock crystal
C1	1,000 $\mu$ F/25V	Aluminum electro cap
C2,C12-19		0.1 $\mu$ F/50V Mono ceramic cap
C3	47 $\mu$ F/25V	Aluminum electro cap
* C4,6,9,20	10 $\mu$ F/25V	Aluminum electro cap
C5	1 $\mu$ F/25V	Aluminum electro cap
* C7,8	4.7 $\mu$ F/25V	Aluminum electro cap
* C10,11	22 pF	Ceramic disk
R1,6-9	330 ohm 1/8W	Carbon film resistor
R2	1k 1/8W	Carbon film resistor
R3-5	10k 1/8W	Carbon film resistor
S1,2		DPDT toggle switch
S3	N.O.	Push-button switch
T1	115V TO 12.6 VAC 300 mA	Transformer (Radio Shack #273-1385)
J1	1/4-inch	Open circuit phone jack
J2	1/4-inch	Open circuit stereo phone jack
J3	DB9	9-pin female D jack
J4	Power jack	
BP1	Piezo beeper	(Radio Shack #273-065)
F1	1/4A	Fast blow fuse and holder
* PC board:	A drilled and etched PC board is available from the author at P.O. Box 140, Gorham, NH 03581 for \$11 ppd.	
Box		Radio Shack #270-253
(4)	11/16" Standoffs	Radio Shack #276-195
* Part of Suncoast Technologies Kit #70691C,	\$27 + 2.90 S+H, P.O. Box 5835, Spring Hill FL 34606; Tel. (904) 569-7599.	
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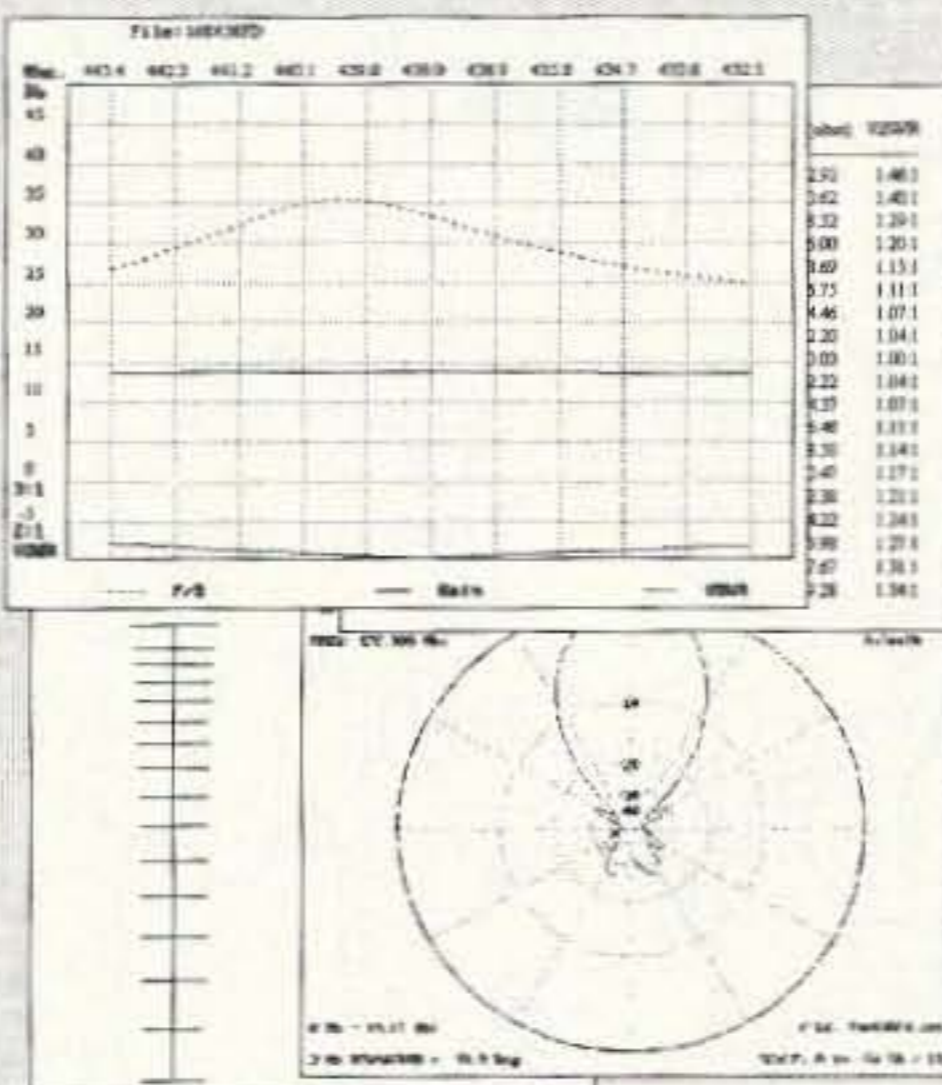


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The 7805 voltage regulator requires a small heat sink.

As this is a digital device, it should be mounted in a metal box and bypass caps added at all the input and output jacks. This keeps RFI from your transmitter from getting into the A.M.C.I. and RFI from getting out of it. I built mine into a Radio Shack #270-253 box.

If you add the speed-indicating LEDs it would be a good idea to mount them on a small strip of perf board.

You can build in an AC supply like I did or use one of the 9 VDC, 500 mA wall-mount plug-in type supplies that are so common today. Don't forget to jumper pins 4, 6, and 8 together on the DB9 jack. If you don't, your computer will not recognize that there is a device connected to it. I mounted the DB9 jack on the back of the box and used a shielded female-to-male DB9 extension cable between my computer and the A.M.C.I.

The front panel artwork was created on my computer and copied onto Graphic Applique film, using a technique described by Marion Kitchens K4GOK in the May 1993 issue of 73.

If you don't need the sidetone you might want to add a switch to switch in or out the beeper. This way you can use the A.M.C.I. as a code practice generator. Just about anyone can send code to you using the keyboard. A good two-finger hunt-and-peck typist will have no problem even at 20 wpm. Or you can record the code on a tape recorder for practice later.

#### Getting the Program Code

One of the problems with building a computer project like this one is getting the program code. It is not practical to publish the program code in the magazine, so you will just have to send away for it or download it with your modem from the 73 BBS (603-924-9343).

A 3-1/2" disk with the assembly source code listing, INTEL HEX file, binary file and the dumb terminal program called "THE TERMINAL" is available from me for \$3 postpaid (Box 140, Gorham NH 03581). If you can't blast your own ROMs, I can also supply a preprogrammed 27C64 EPROM along with the disk for \$10.

#### Last Words

Since the only mode I work is CW, this project has been very handy. No longer do I use up reams of paper, and my fingers don't get numb from having a death grip on the pencil. I hope this project helps you to get more use out of your computer and enjoy CW more often. So if you've never had anyone tell you "great fist—pleasure to copy," this project is perfect for you! Let's all help keep CW alive and well.

73

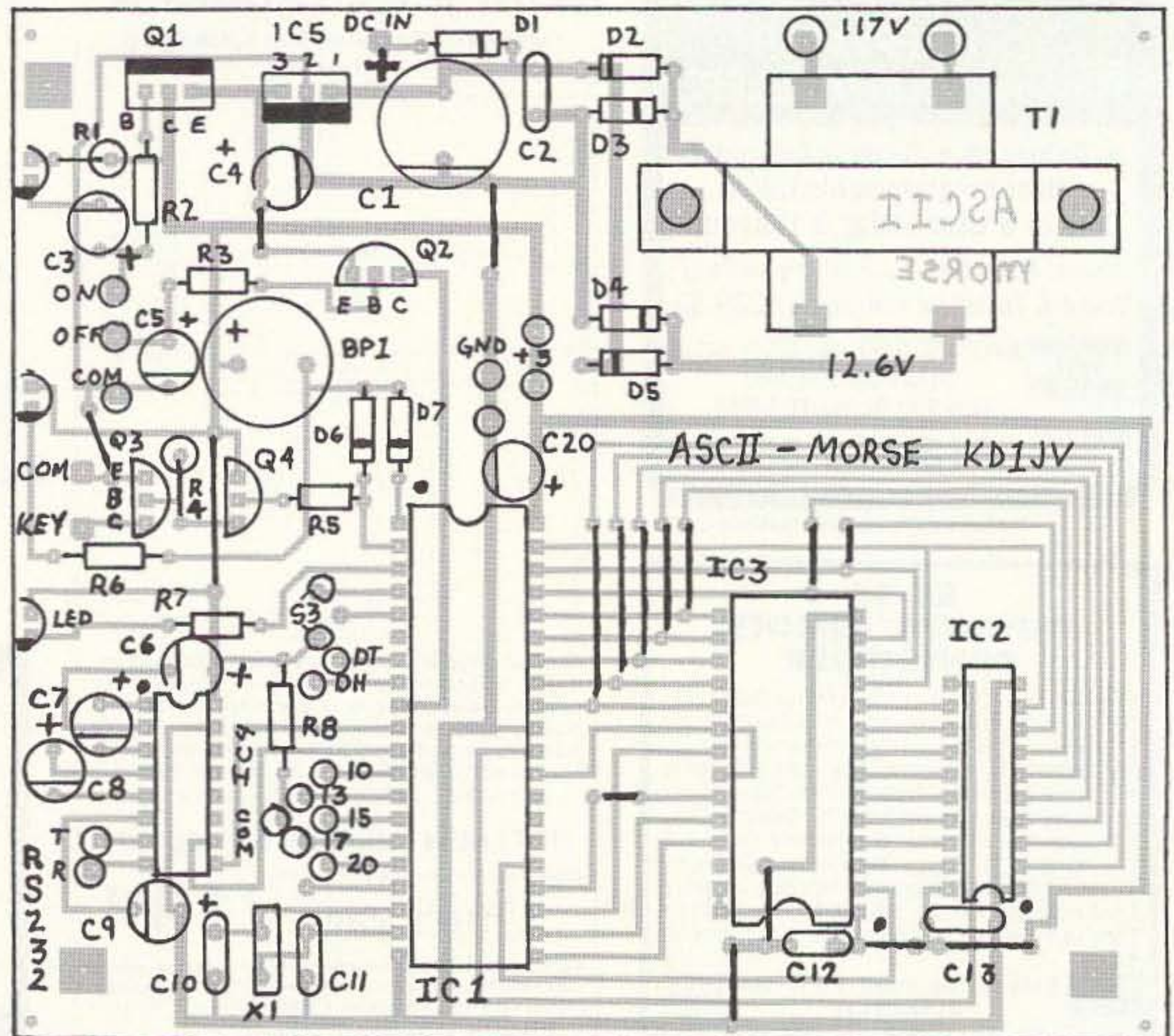
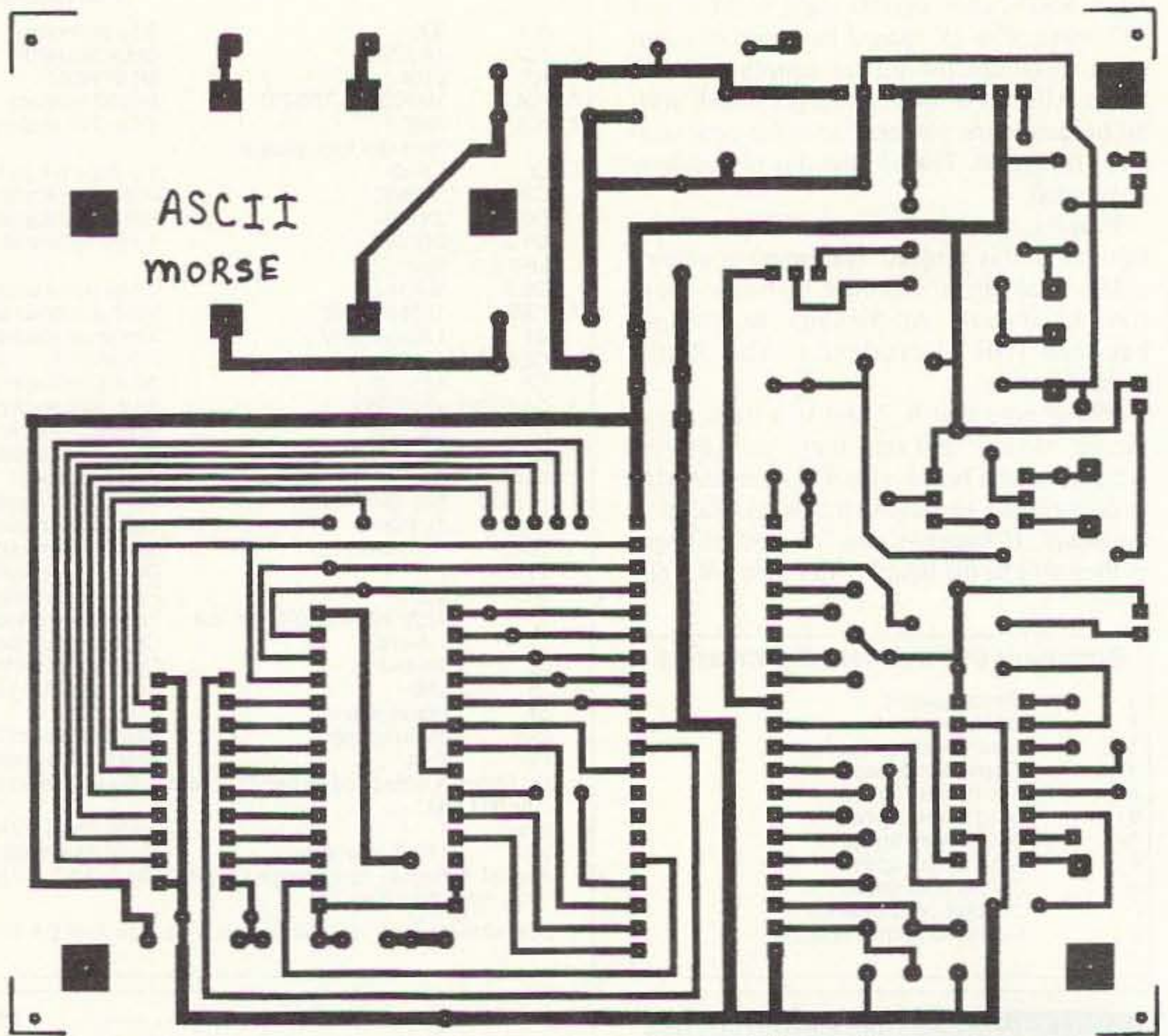


Figure 2. PC board foil pattern and parts placement diagram.

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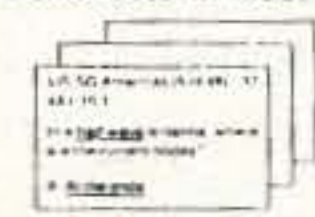

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# Standardize Your Microphone Connectors

*A one-plug-fits-all solution you can easily build.*

by Klaus Spies WB9YBM

My initial reason for standardizing the microphone connectors on all of my transceivers was to allow interchangeability of home-brew station accessories among my radios. It also occurred to me that, in the event of a microphone failure during emergency communications, being able to grab

the nearest convenient microphone (and having it work right away) would also be a big advantage.

### A Look at Connectors

Older radios in my shack had three-pin connectors, while the majority of more modern radios have four pins, with the fourth pin being unused. Standardizing to the more modern four-pin connector made the most sense, since the older three-pin connectors are not commonly available. The four-pin connectors can be found at most parts stores, hamfests, and the like.

Having the fourth pin unused turned out to be a blessing in disguise. When requiring a signal from the squelch to trigger a tape recorder (for logging), or to enable the PTT of another transceiver in a link, it was very easy to build and install an interface circuit right inside of the radio (see page 27 of the December 1988 issue of 73). That signal could be conveniently brought out through pin four.

scheme is helpful. In my case, the determining factor was my HF rig; because it seems like the most complex rig in my shack, it was the transceiver I was least likely to open up and modify. Using pins one through three as ground, audio, and PTT, leaves pin four open for accessories, putting the least important function last. The order of the other three is not really important as long as there's consistency in the entire hamshack.

The only fly in the ointment is with converted CB transceivers. Even those that work with the microphone removed (some older ones do not) had microphone switches that were DPDT, one side toggling the PTT to ground, the other toggling some point in the transceiver between the microphone and the receiver circuit (Figure 1 shows the typical example of this). By comparison, the standard switching of amateur gear is a bit more straightforward (see Figure 2).

Figure 3 shows how a CB can be made to operate with a typical ham microphone. If the "RCVR ENABLE" of Figure 1 (the N.C. on Figure 3) is connected to anywhere but ground, connect pin 4 of U1 there, instead of ground (the same holds true for RCVR DISABLE on Figure 1 and N.O. and pin 11 on Figure 3).

Unused gates of the ICs should be connected to +12V or ground, as convenient. I installed the circuits I built right into my transceivers, as far as possible from the transmitters' final amplifier. This ensures good shielding of the circuits from the RF in the hamshack, and avoids the high RF in the rigs' PA. 73

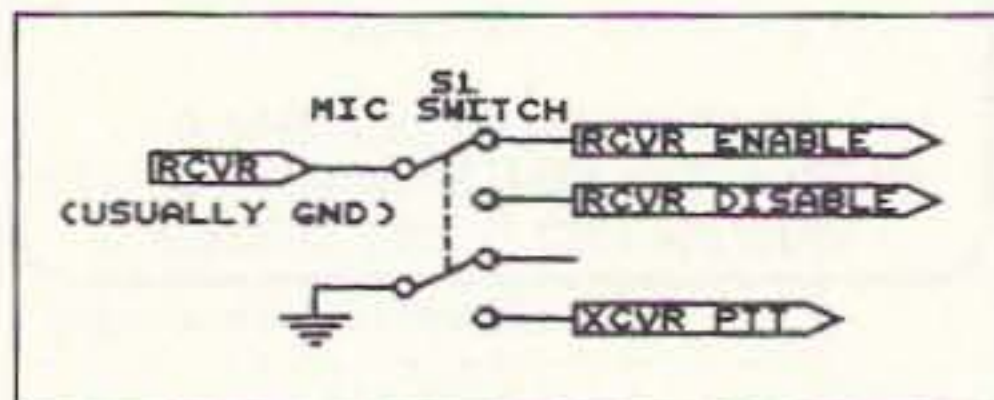


Figure 1. Typical microphone switch in a CB transceiver.

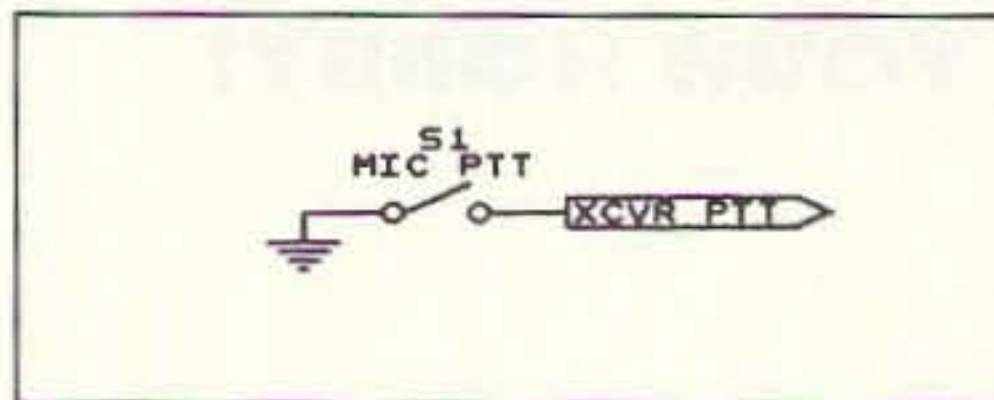


Figure 2. Microphone PTT switch for most ham transceivers.

### A Look at Wiring

Deciding beforehand on the wiring

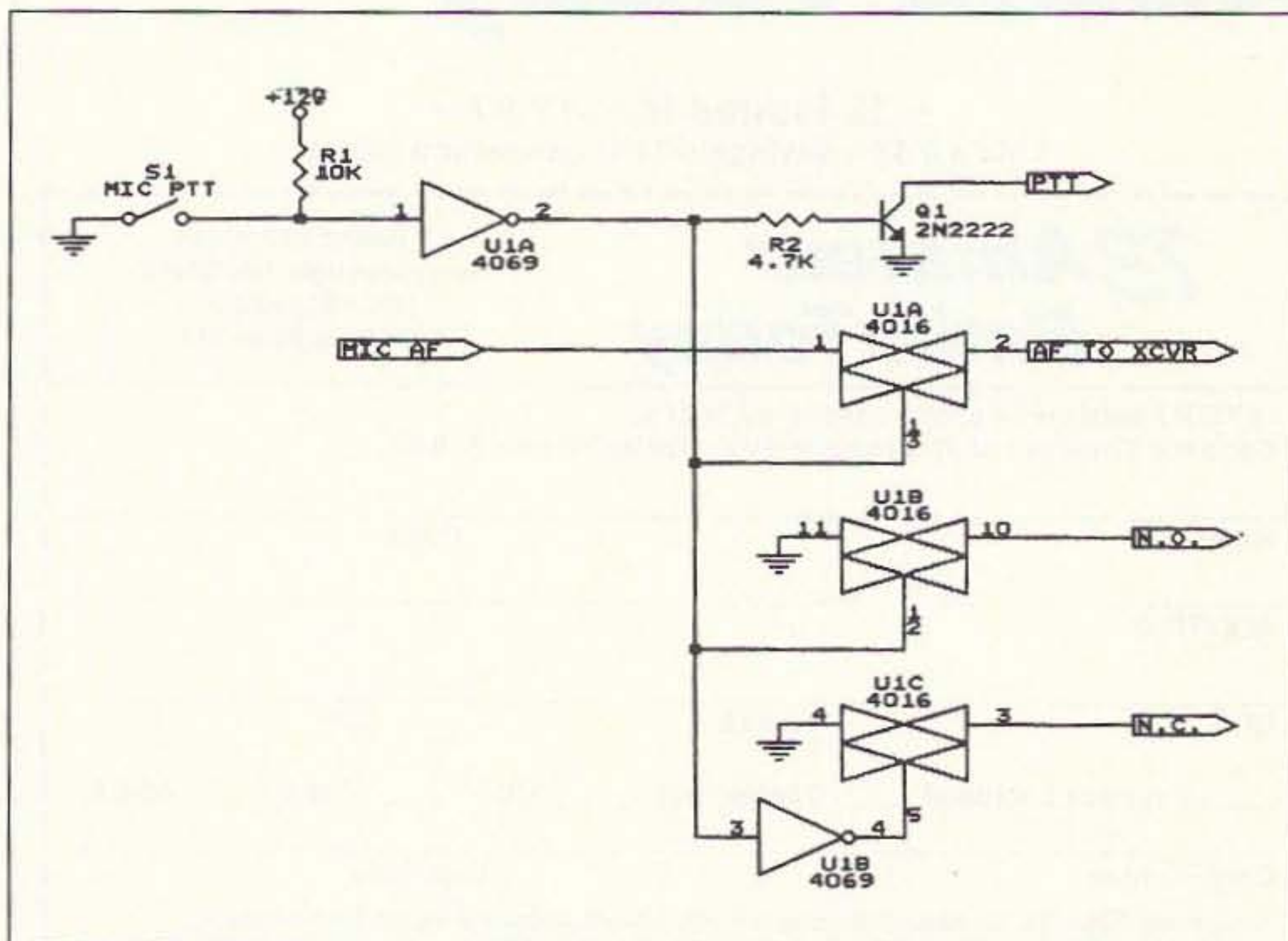


Figure 3. With a standard microphone switch, this circuit will interface to most CB transceivers.

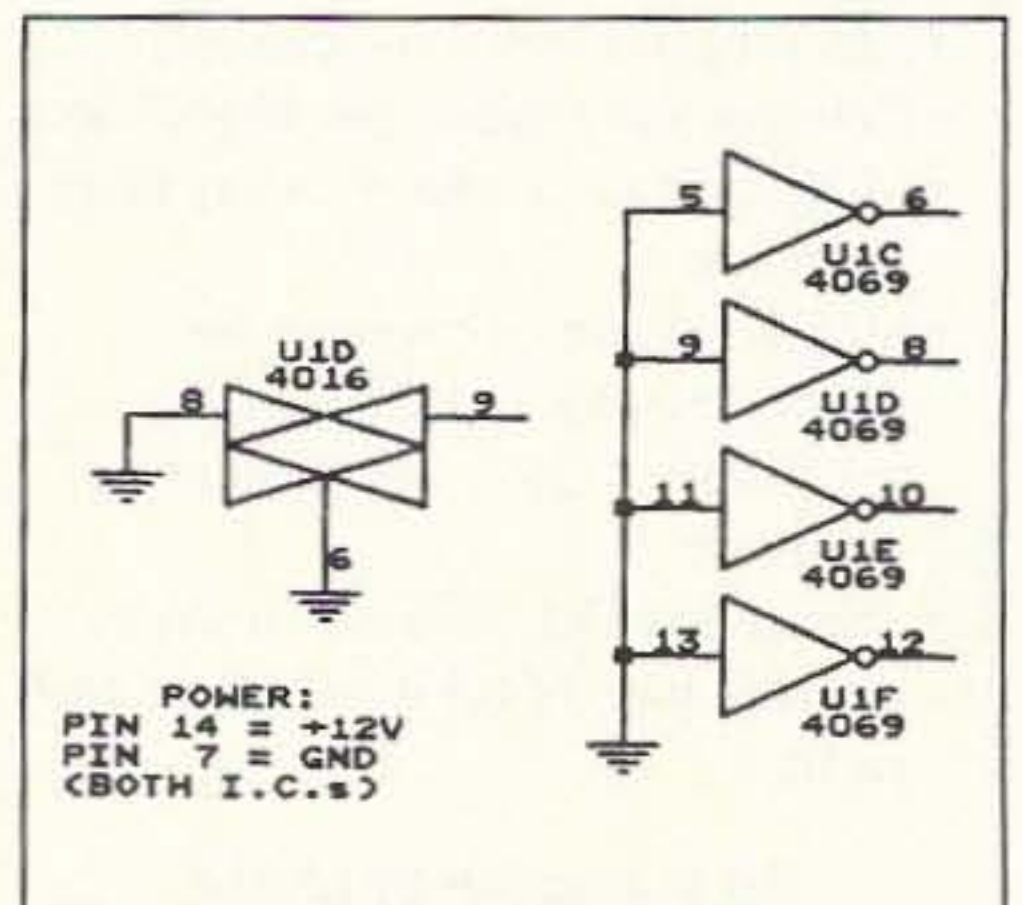


Figure 4. Unused gates should be connected to +12V or ground.

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# Folding Three-Element 2 Meter Quad

*Finds fox, folds, fits in trunk.*

by John E. Myers WX8G

I've been interested in radio direction finding for about six years and I've always had good results with my home-brew five-element yagi. Its shortcoming, however, was that it was too big to fit into the trunk of our car. I'd been reading about the quad vs. yagi debate (*73 Magazine*, January 1989: "Quads vs. Yagis for Fox Hunting"; by Joe Moell, P.E., KØOV) and had decided to try a quad. I knew that it would work well for radio direction finding, but it wouldn't fit in our car. So, I figured that with a little extra effort, a folding quad would not be too difficult to build.

The folding three-element quad is designed to work well across the entire 2 meter band, and has excellent gain and front-to-back ratio, as well as good side rejection. It is also easily folded, and unfolds in a matter of seconds. Yes, I said seconds. The secret to the folding quad is a notch in the boom which the driven element drops into when unfolded. The driven element is mounted to the boom with a spring-loaded bolt (see Figure 3) which holds it firmly in position. To fold the quad, you simply hold the boom with your hand while pushing up with your thumb. When the support for the driven element clears the notch, you simply fold it up. The elements are connected together with a tie rod which keeps them parallel to one another. In its folded position, the folding quad easily fits into the trunk of the average compact car, which makes it ideal for fox hunt-

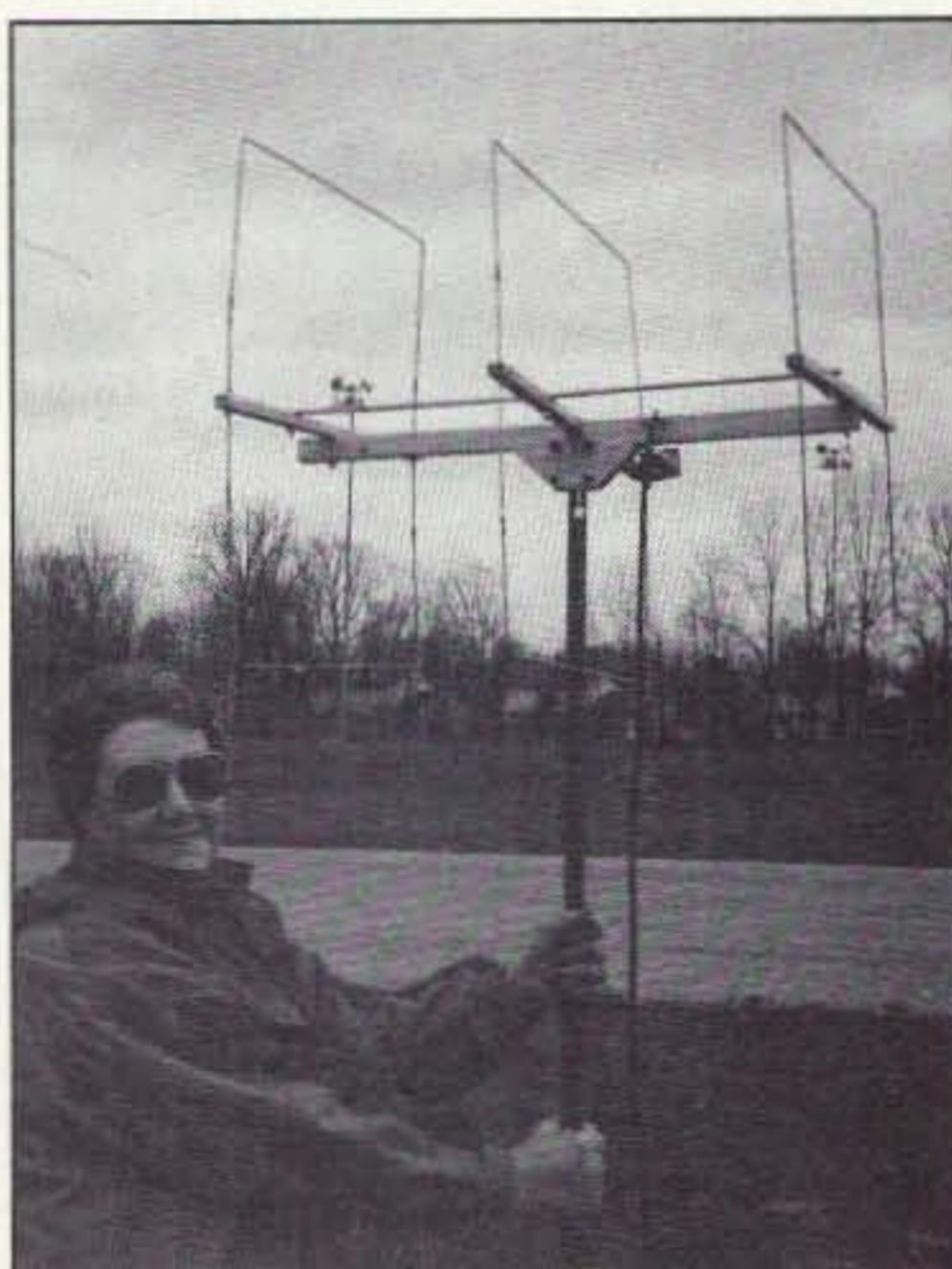


Photo A. Pam N8IAK shows her pleasure with the folding quad.

ing. You should have no trouble building this antenna in just a few evenings, for less than \$20.

Using the dimensions shown in Figures 1 and 2, I cut all the supports and the boom from a piece of construction-grade southern pine. The notch in the boom is very important. When not folded, the support for the

driven element rests in this notch. I recommend cutting the support for the driven element, and finishing it, first. Then, using it as a cutting guide, make the notch in the boom. The fit should be as close as possible, without being too tight when the quad is unfolded. After the pieces are cut and drilled, sand them smooth and finish them with at least two coats of varnish.

The elements are made of 1/8" brazing rod. It is readily available, rigid, and easily bent—with the help of a propane torch. I used eight 36" lengths to complete this project (if brazing rod is too expensive or hard to find, try 12-gauge aluminum ground wire. It's cheaper and easier to work with, but not as rigid). To bend the brazing rod, clamp it into a vise, heat it until it's almost red hot (a propane torch will do fine), and bend it v-e-r-y gently. Take your time, practice on some scrap rod first, and remember: measure twice, bend once.

Refer to Figure 2 for the dimensions of each element. I found it easiest to make my first bend before inserting the rod through the hole in the support. Since it takes a little more than two rods for each element, you'll need a union to join the rods to one another. I use a union that I made from some small-diameter copper tubing that I bought at my local auto parts store. With pipe cutters, I cut off a piece about an inch long and drilled it large enough to accept the brazing rod. To

*Continued on page 50*

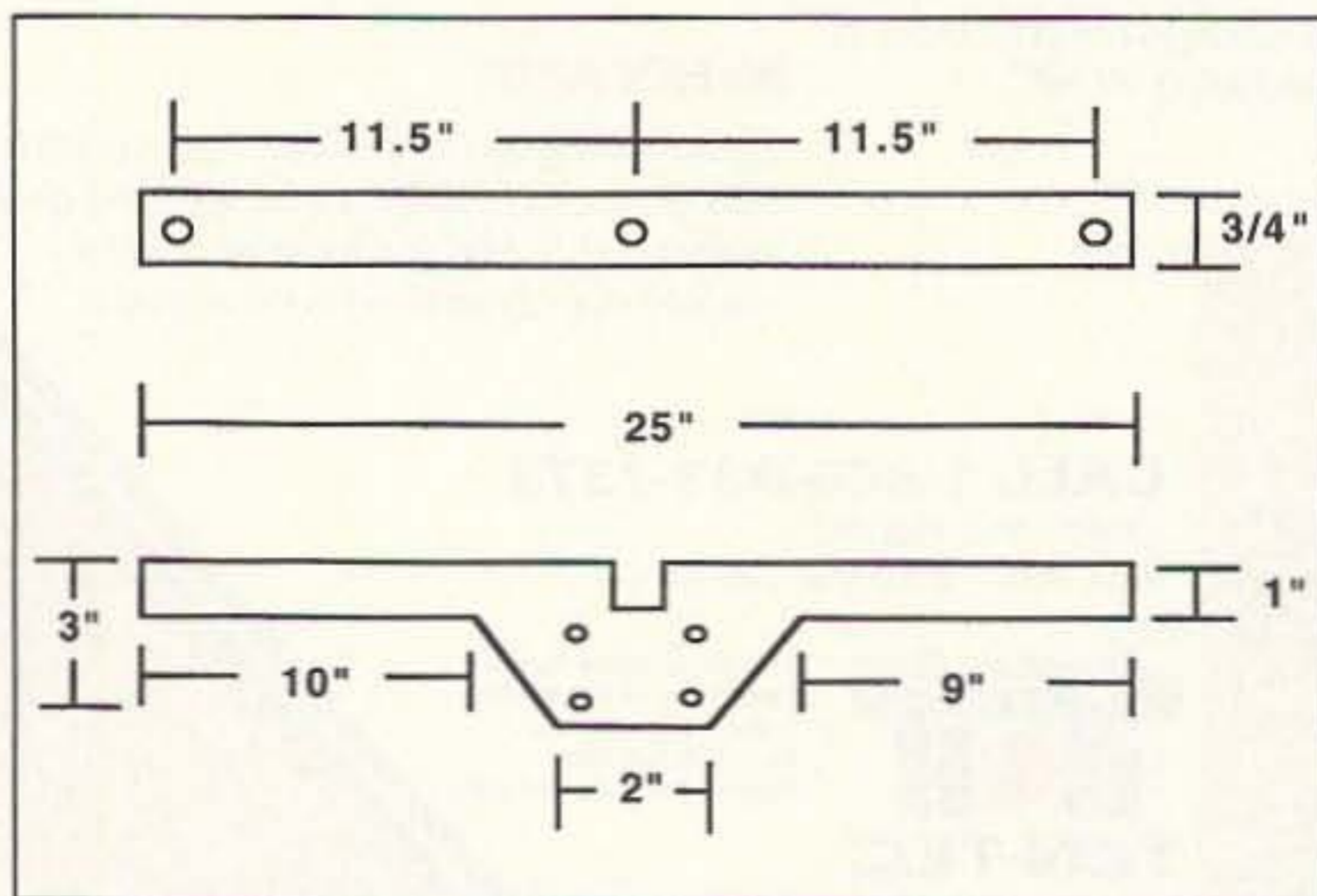


Figure 1. The boom: Cut and drill as shown.

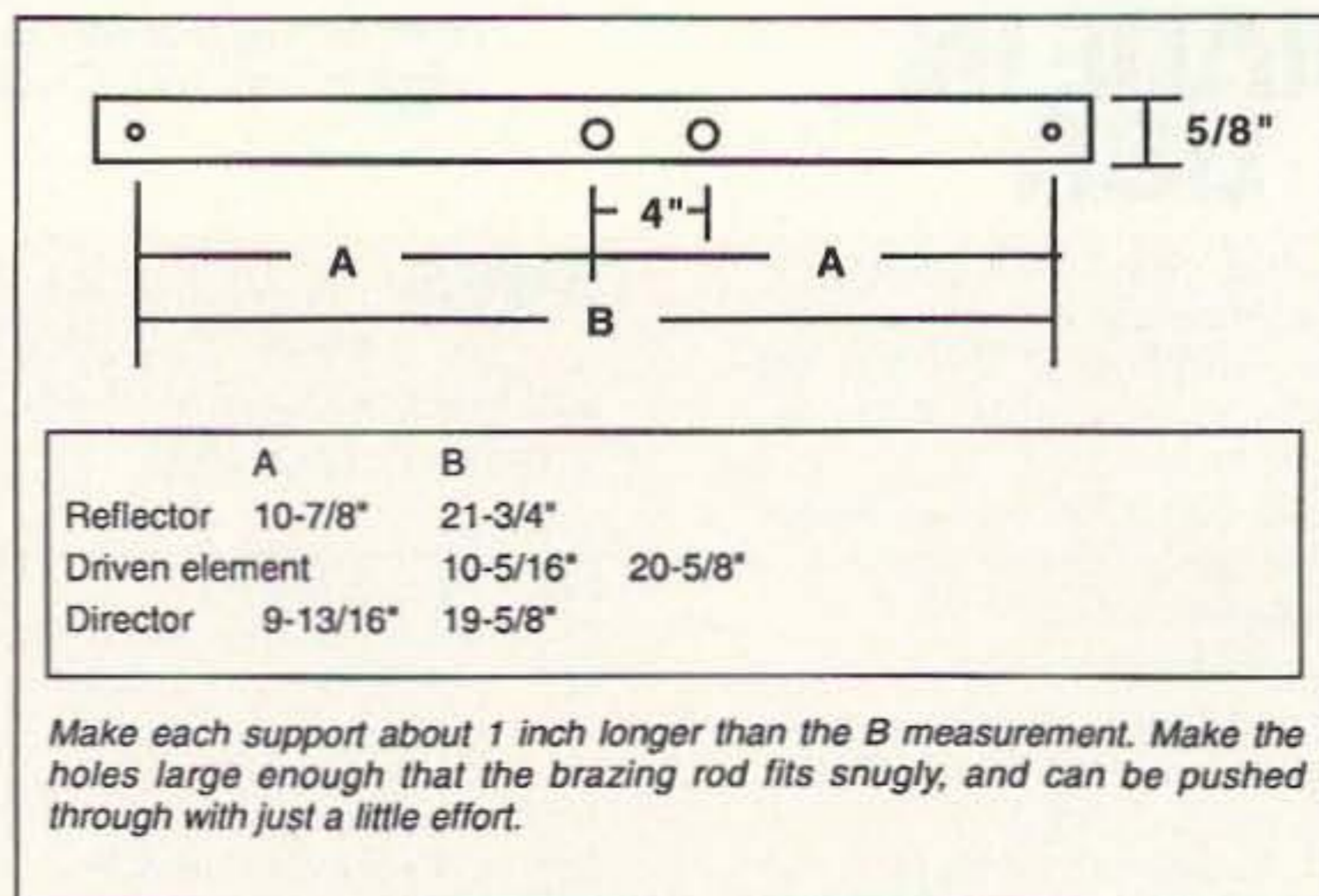


Figure 2. Dimension table for the quad.



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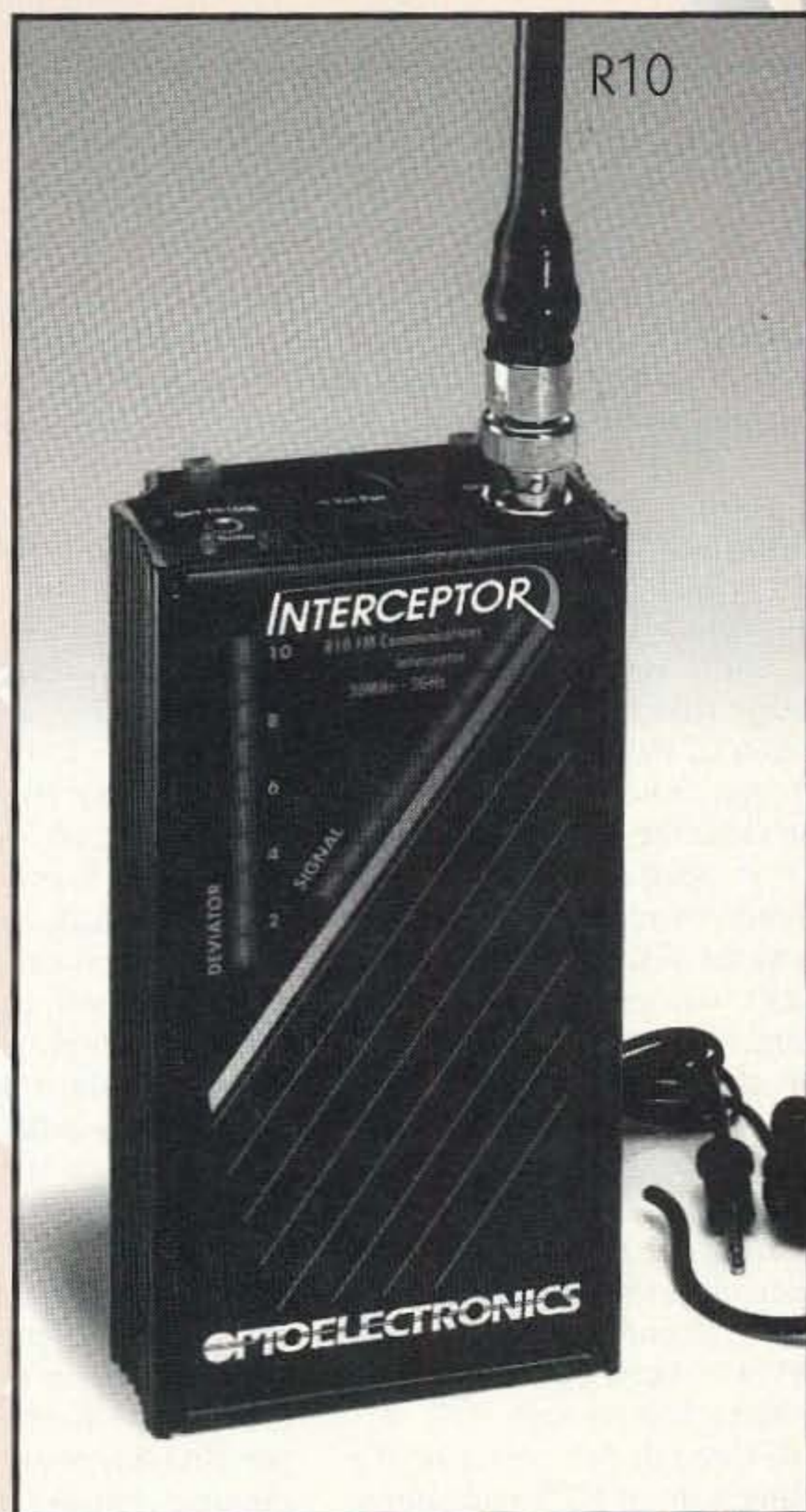
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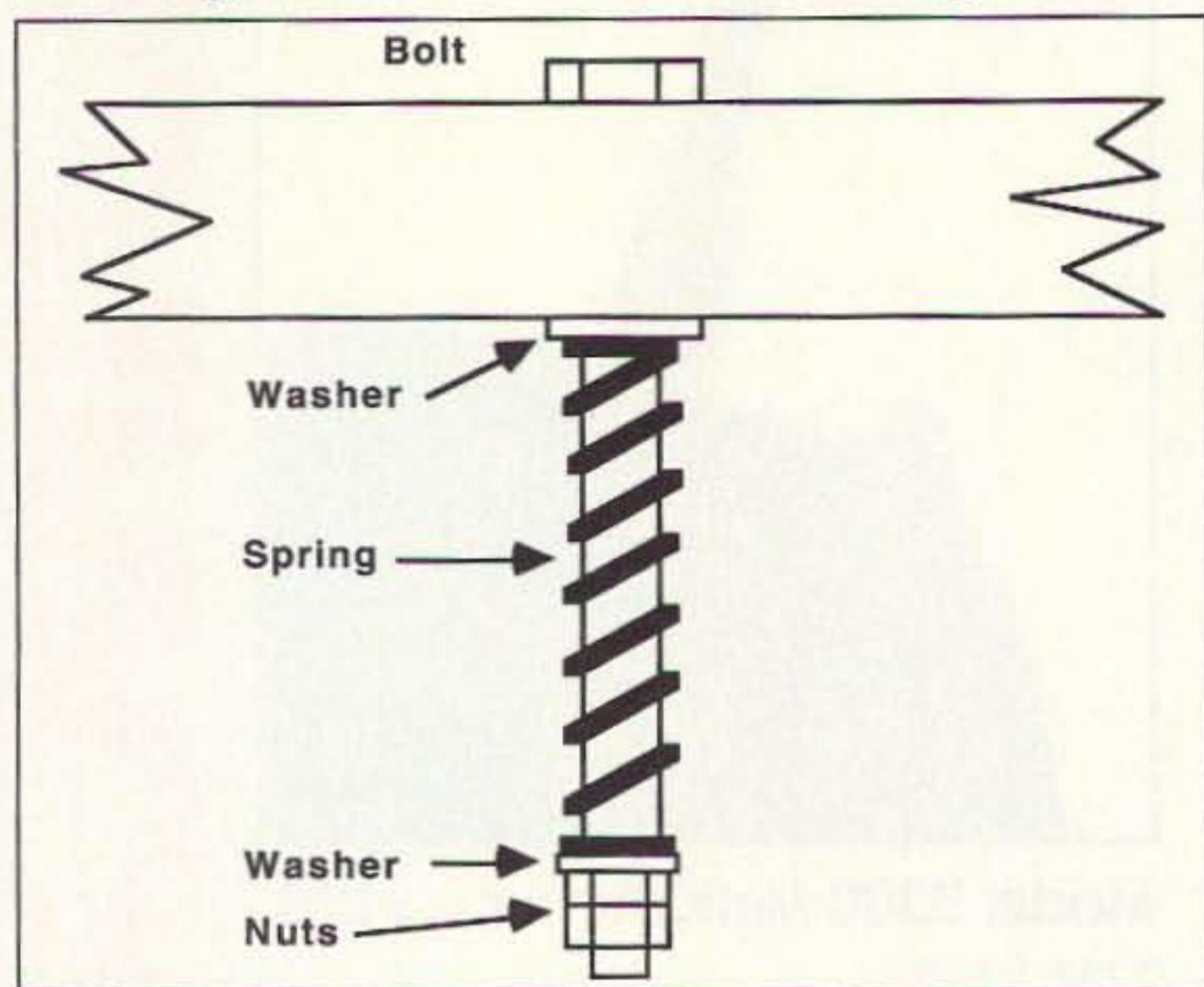


Figure 3. Close-up of the spring loaded bolt which makes up the pivot point of the quad.

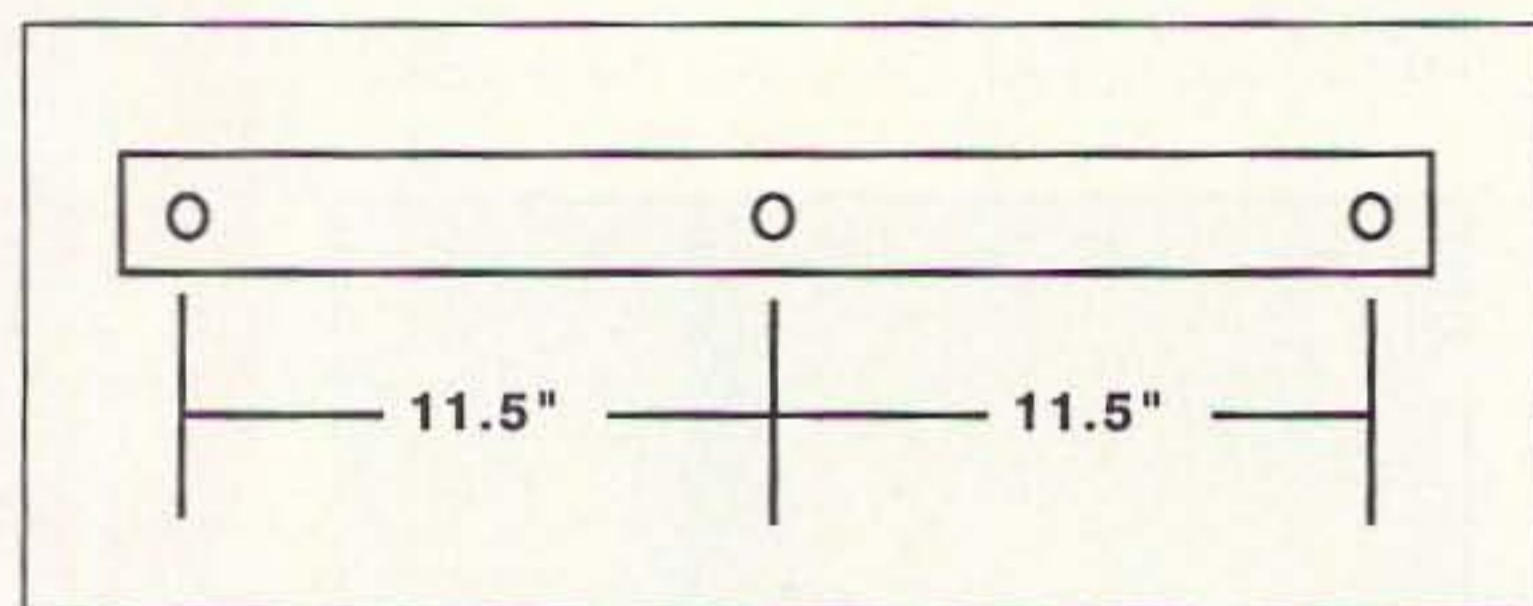


Figure 5. Tie rod—this is made from a thin piece of wood. The only dimension that is important is the one listed. Its purpose is to tie the elements together, and keep them in alignment, while folded and unfolded.

join the rods, shine up the ends with steel wool. Insert the rods into the ends of the union and solder them in place. You can use a torch for this, but I've had better results with a high-wattage soldering gun.

The construction of the driven element is just a little different from the others. First, remember not to close the loop on the driven element. Leave it open at the feed-point bracket. The feed-point bracket is pretty simple. I took a piece of scrap plastic (1.5" x 4" x 3/16" thick), warmed it until it was pliable, and bent it at a 90-degree angle. Then I drilled as shown in Figure 5, mounted the SO-239, and mounted the assembly to the support, using screws. The driven element is attached to the feed-point bracket with nuts and bolts. I soldered electrical crimp-type ring connectors to the ends of the elements to make a cleaner connection. Another way would be to bend ends into a loop big enough to insert a bolt through.

Insert the bolt through the center of the support, and, using a bit of RTV compound, or epoxy, glue the bolt to the support.

Now that the elements are finished, it's time to assemble the quad. First, using Figure 4 as a guide, attach the elements to the boom, paying special attention to the spring and washer placement on the driven ele-

ment. Next, attach the tie rod. This should complete the mechanical assembly of the folding quad. After the matching is done, and you're satisfied with the operation, apply a bit of RTV to the end of all the bolts to keep the nuts from coming undone.

I had very little trouble matching the quad. I took all my measurements outdoors, using an HT and a VHF SWR meter. To match the quad, I simply varied the length of the jumper wires between the ends of the driven element and the SO-239 connector. Once matched, the SWR was acceptable across the whole band. I found that a difference of only a half inch can be significant. The trick that worked best for me was to make the jumper about 4" long, then attach one end to the SO-239 and an alligator clip to the other end. I then attached the alligator clip to the element and, using trial and error, slid the clip back and forth along the element until I found the perfect match. When you find this point, measure the length of the element between the clip and the point where the element attaches to the feed-point bracket. Subtract this from the length of your jumper wire. The result will give you the length of your jumper wire between the mounting bracket and the SO-239.

All done? Great! Now, insert the U-bolts

through the boom, then insert the mast. Now you're ready for the next fox hunt.

Field tests were encouraging, and wherever I go the folding quad generates a lot of questions. So far the quad has been used in enough hunts to tell me that I probably won't go back to a yagi anytime soon. 73

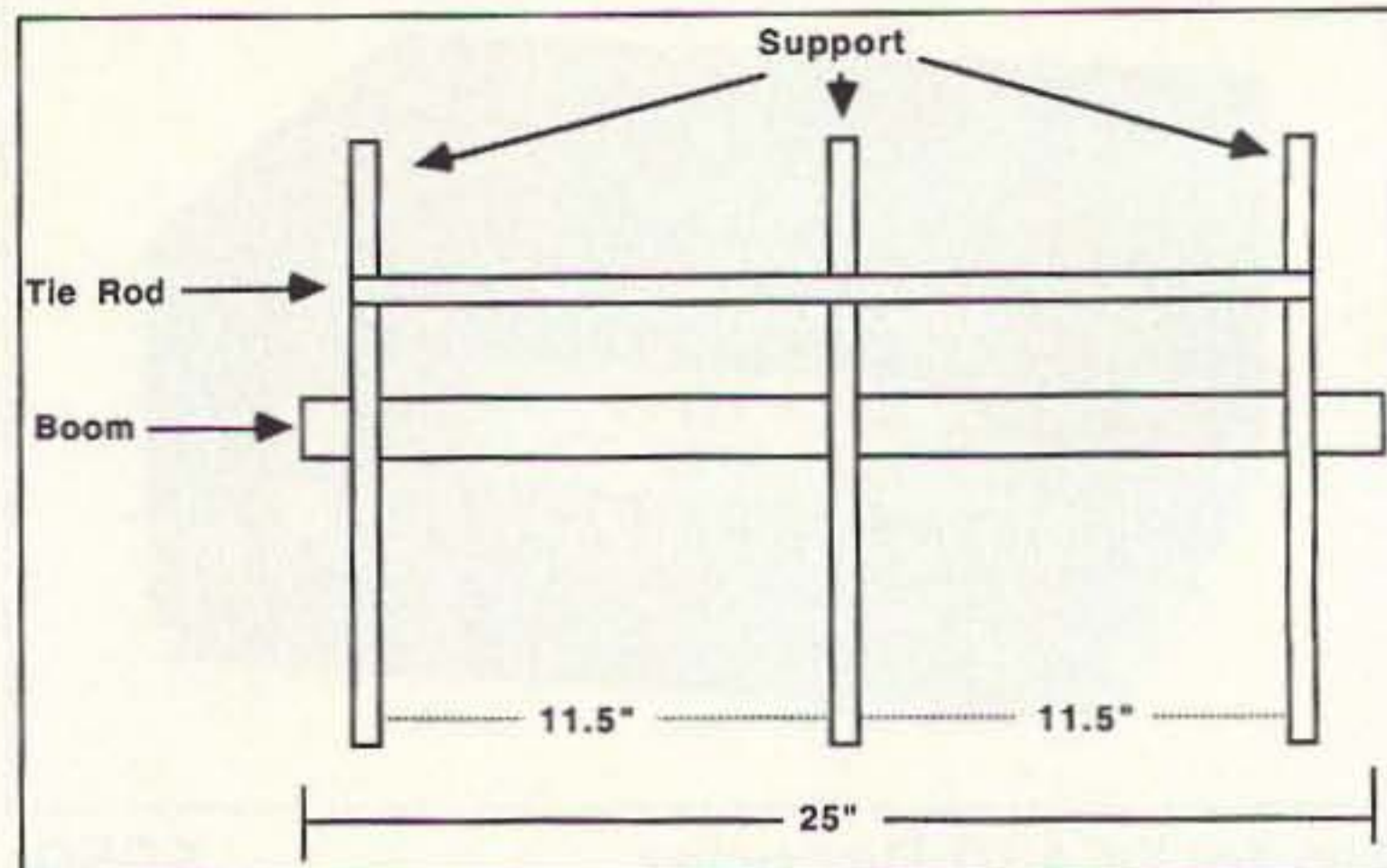


Figure 4. Top view of the folding quad. The spacing shown is 0.15 wavelength.

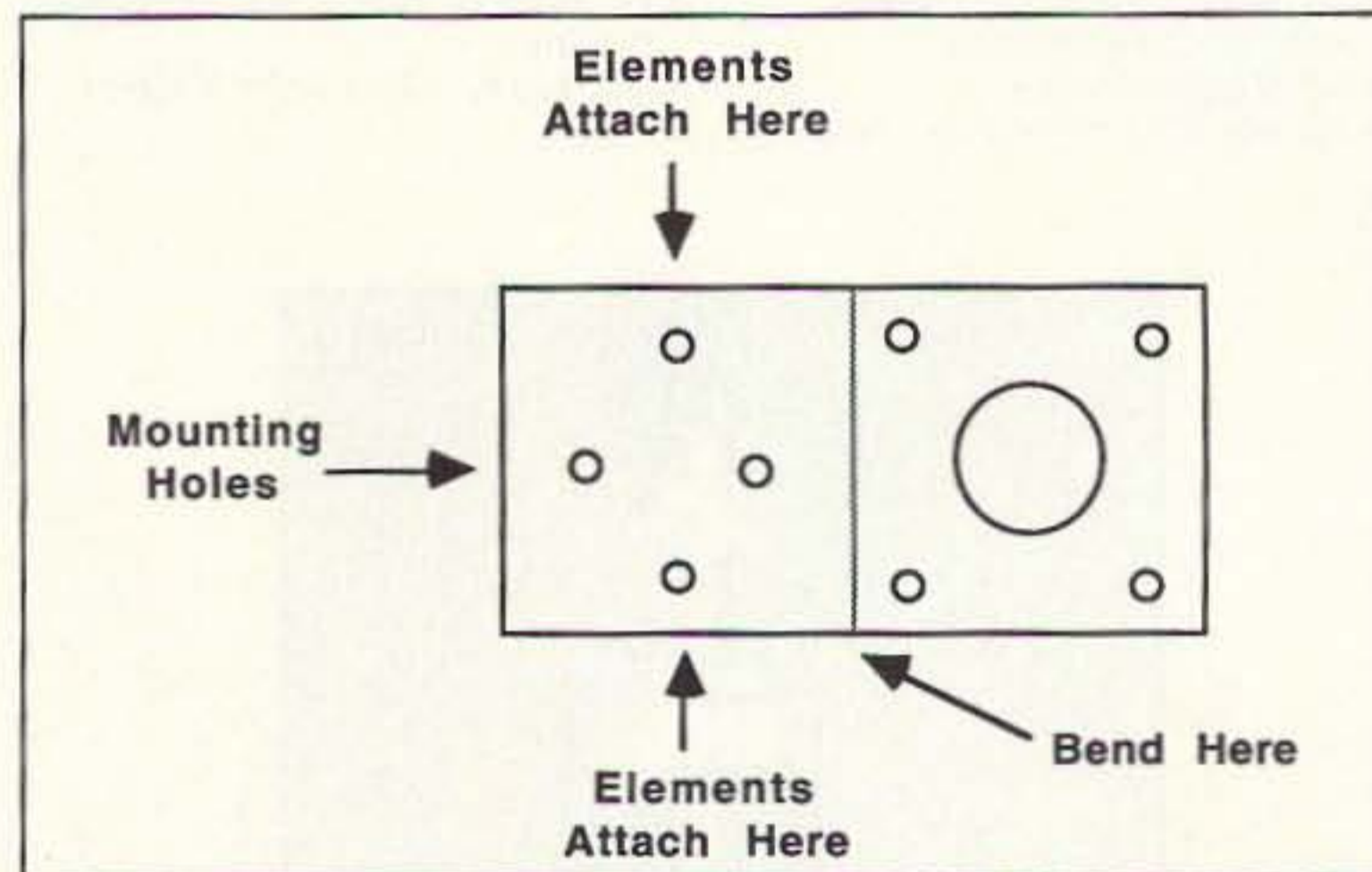


Figure 6. Feed-point bracket. Mount SO-239 on the right side. Mount to the face of the bracket, using 6-32" x 3/8" bolts, attached from behind. Run jumpers from SO-239 to the elements (see text).

### Parts List

- 1 2' x 4' x 8' pine stud
- 8 36" brazing rods
- 1 foot copper tubing (see text)
- 2 U bolts
- 1 broom handle (mast)
- 1 1.5" x 4" piece of plastic for the feed point
- 1 SO-239 (Radio Shack part #278-199)
- 2 10-24 x 2.5" screws
- 3 10-24 x 1.25" screws
- 1 1/4 x 4-1/2" screw
- 6 6-32 x 3/8" screws
- 2 4 x 1/2" wood screws
- 5 #10 washers
- 2 1/4" washers
- 5 10-24 nuts
- 2 1/4 x 20 nuts
- 1 spring (available at your local home center)
- 2 6-32 nuts
- 5 Ring terminals

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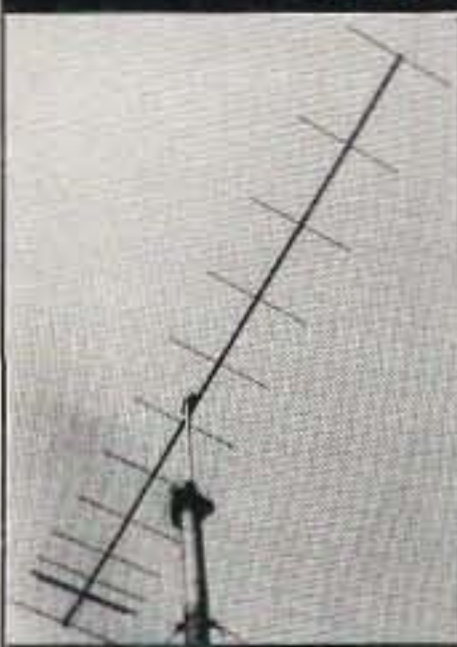
The 10 meter test had started, and I expected the band to open about the time I arrived at the motel. Rig and gel cell were in the trunk. Maxi-J was right beside, rolled up inside the launcher pail. Room with a view. Maxi takes off from the balcony sloping down to a tree. His tail slips under the door. And I'm 59 in Japan.

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SWR ..... 1.13:1 typical  
F/B ratio ..... 22 dB  
Maximum power ..... 2000 Watts  
Impedance ..... 50 ohm

**MECHANICAL SPECIFICATIONS:**  
Length ..... 17 ft 4 in  
Boom ..... 1.375" 6061 T-6 Aluminum  
Elements ..... 1/4" Aluminum rod  
Wind survival ..... 120+ MPH  
Mast ..... up to 2" diameter  
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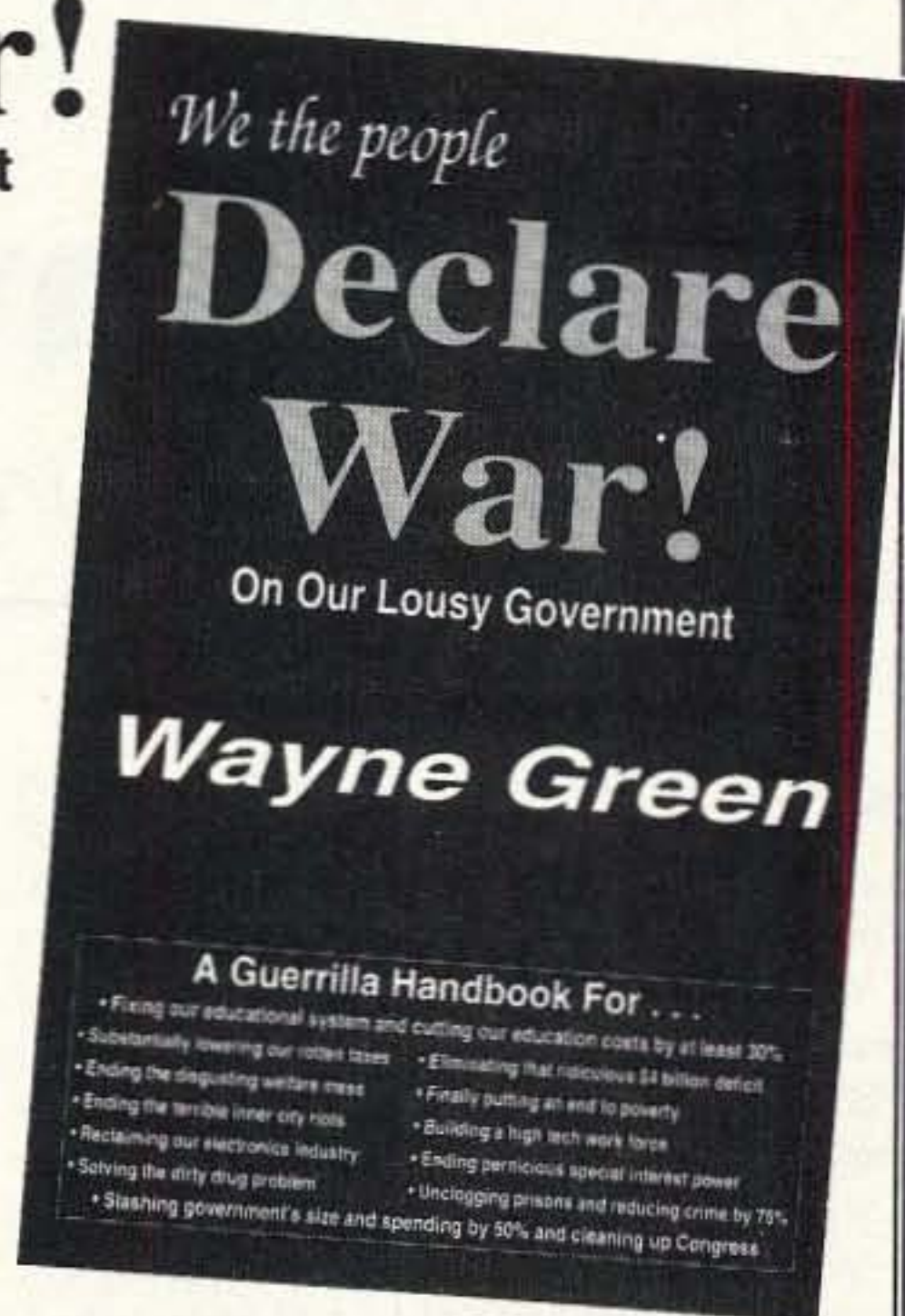
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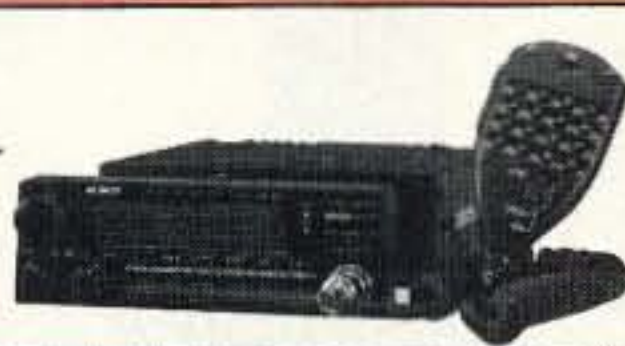
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Telephone: (310) 639-4200  
Price Class: \$399

*2 meter hand-held transceiver.*

Kenwood has done it again by producing a tiny, lightweight and affordable VHF handheld that seems to do everything well. The TH-28A is a 5-1/8" x 2-1/8" x 1-3/8" (H x W x D) do-everything handie-talkie that weighs in at only 12 ounces, including its PB-13 standard nickel-cadmium battery pack. It contains some interesting features not previously available in "mini" HTs.

For example, in addition to covering the 2 meter amateur band (144-148 MHz) with 2 watts of transmitter power (using the normally-supplied 7.2V, 700 mA/H battery pack), the TH-28A also receives the public service VHF band (136.000 to 173.995 MHz) FM as well as the VHF aviation band (118.000 to 136.000 MHz) AM, and is capable of storing these frequencies in memory or scanning through them, just like a high-priced "scanner." In addition, it contains a "subband" receiver which tunes 438.000 to 449.995 MHz, thus covering the entire 70 cm amateur FM subband (for reception only).

Unlike many earlier-generation HTs, the TH-28A can be charged during operation, as plugging in a battery-charging source does *not* disable the little rig. And it can be operated *directly* from a 13.8 VDC power source, including the optional PB-14 battery pack, or your automobile's cigar lighter, or a base-station power supply; and if operated at this higher voltage, the tiny radio produces 5 watts power output!

Other interesting features include:

- 40 programmable memories, easily programmed with very user-friendly instructions. Once you've done it the first time, you *won't* have to refer to the instruction manual again!
- A well-written 63-page instruction manual to get you going.
- Built-in DTMF tone pad *and* CTCSS "PL" tones (39 CTCSS tones total) are standard.
- CTCSS ("PL") tones as well as TX/RX frequency offsets are all stored in each memory for quick and convenient QSY.
- The transmitter can operate at any of *four* power levels, from full power down to 20 mW for line-of-sight work and extended battery life.
- DTMF memories (10 total, storing 15 digits each) allow full "autodial" operation for telephone patching.
- Programmable TX delay time to prevent

TX unkeying during autopatch or control system dialing.

- Dual-tone squelch system is standard in U.S. models, allowing DTSS "paging" with prearranged signals.

- DTMF (touch-tone) paging is also designed into the TH-28A, allowing programmable paging codes to identify the calling party.

- Built-in 24-hour clock, accessible anytime you wish by pressing F+9 on the front-panel keypad.

- To supplement the

clock function, it also has a built-in electronic timer and alarm—you can literally use the HT as an alarm clock if you wish!

- Crossband operation, transmitting on 144-147.995 MHz while receiving on 438-449.995 MHz, is possible by pressing the F+BAND keys.

- A large (3/16" alphanumeric) display which indicates RX frequency on receive and TX frequency on transmit, including a full-sized "5" digit, with back illumination available by depressing the "LAMP" button, is easy to read day or night.

- In the VFO mode, any frequency within its coverage range may be programmed directly using the front panel keypad. (For example, to dial up "146.520" MHz, you'd simply push the "VFO" button, followed by 4-6-5-2-0 and you're there!)

- Battery voltage is monitored and displayed every time you transmit, so charge state can be determined in advance of the unit "running out of gas."

- With its Battery Saver function on (this is a default), battery life is incredibly long: The standard PB-13 seems to last more than 24 hours (RX only) or eight hours of TX/RX in the "low" power mode (500 mW output) with 50% duty cycle; it lasts about five hours in "high" power (2 watts output) with 50% duty cycle. This is long enough for almost anybody. The rig gives you sufficient warning that the battery is running down so you can switch to a charged spare.

## That's Not All

Sound like enough features? There's more. The TH-28A's "on/off" power switch is *electronic*, and is a recessed press-switch which is not easily depressed accidentally; but even if it were momentarily depressed, this would not turn the unit on, as the button must be depressed for more than one full second before it functions. This is a good feature—it saves the battery pack from inadvertent turn-ons. You can switch memory channels (in the "MR" memory mode) or VFO channels (in the "VFO" mode) using either the front-panel keypad or a continuously rotatable switch mounted atop the unit. If you need to hear a station too weak to break the TH-28A's squelch setting, or one lacking the proper CTCSS tone if your unit is set in the PL RX mode, rather than ad-



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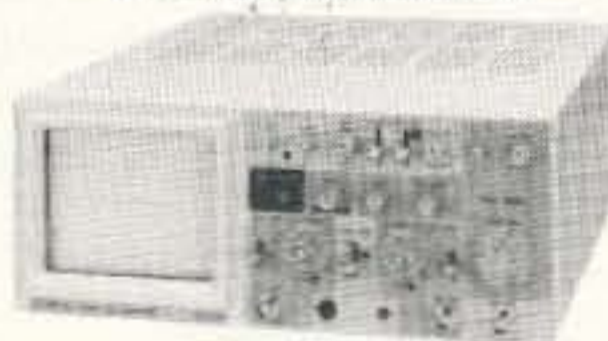
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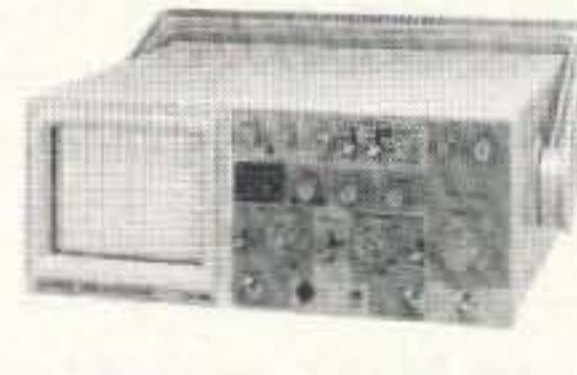


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justing the squelch or reprogramming the rig you may simply press the "MONI" button, which immediately breaks the receiver squelch and lets anything on frequency come pouring right through. Nice!

The TH-28A's 16-digit front-panel keypad may be a bit small, but the buttons are clearly labeled, and spaced adequately for my blundering touch. Possibly a man with really huge hands would have some difficulty, but he'd be the exception. The most-used controls, like "POWER," "MR," "VFO" and "VOL," are quite large and easy to handle for just about anyone.

The rig's frequency steps are programmable from 5 to 25 kHz/step. Every single memory (00-39, a total of 40 are standard) is capable of storing every piece of information that could possibly be needed, and *all* will accommodate "odd splits" (i.e., TX/RX frequency offsets that are not standard). Even some higher-priced, much larger mobile rigs can't do that. Also, the ME-1 memory expansion option will fit the TH-28A to add 200 more memory channels to the unit, for a whopping 240 memories. I can't think of anyone who could possibly fill all those up with anything useful, but it might be fun to try.

If you'd prefer to display information other than the memory channel frequencies, the

TH-28A is capable of displaying anything up to six characters long for each memory channel. These notations can include the numerals 0-9 as well as the letters A-Z. So, if you'd rather remember your favorite local repeater as "BOZO" instead of 147.885

***"The TH-28A's 16-digit front-panel keypad may be a bit small, but the buttons are clearly labeled, and spaced adequately for my blundering touch."***

MHz, the rig can be programmed to display the name instead of the frequency. This function is addressed by one of the many "power up" commands; in this case, it's MR + POWER that selects the alphanumeric menu.

The TH-28A's scanning functions can be either time-operated or carrier-operated, and it's capable of scanning memories: memories excluding "locked out" ones; an

entire band; a portion of an entire band; a 1 MHz range of your choice; a combination of the VFO and the last-used memory channel; a combination of the VFO and the CALL channel (more on this later); VFO + last memory used + CALL channel; and it's capable of scanning either "up" or "down" the band, with reversal of the direction driven by a single click of the tuning control. Whew!

The CALL channel, which would normally be your favorite one, is programmed using the M + CALL keys, and then recalled with a single touch of the CALL key thereafter. This allows you "instant QSY" to the CALL channel in memory, any time you wish, by pressing a single, large, front-panel key.

The unit's TX frequency offset is programmed per the ARRL Band Plan for 2 meters, and this is the normal default. However, the preprogrammed offset can be overridden with another "power up" function, in this case CALL + POWER. Any offset from 0 to 99.9 MHz in 100 kHz increments may be selected manually and retained in memory for continuous use if you wish.

As with most modern handie-talkies, the TH-28A comes equipped with a "LOCK" function (in this case, a slide switch) which turns off all controls except LAMP, MONI and PTT to prevent inadvertent reprogramming or QSY. It also comes standard with an AC-powered "wall charger" (15 hours to fully recharge a depleted battery pack), a belt clip (removable), carrying strap, flexible "rubber duckie" antenna, and a standard nickel-cadmium rechargeable battery pack.

The antenna connector is a standard BNC receptacle (thank goodness—no weirdo plugs required), and even with the flexible antenna installed the overall height of the TH-28A comes to nine inches: Still a "pocket rocket" to be sure. Optional accessories available (but not normally supplied with the radio) include: a speaker mike SMC-33 which features remote programming functions; the memory expansion unit ME-1 discussed earlier; a battery case BT-8 to hold alkaline batteries; a 12 volt nickel-cadmium battery pack, PB-14, rated at 300 mAH, which allows 5 watt operation (but not for long!); a clip microphone with earphone, EMC-1; a full-blown headset with VOX or PTT for transmit control, Model HMC-2; a base-stand rapid charger BC-15, which will recharge the NiCd battery packs in only one hour; a water-resistant bag WR-2 to allow operation in the swamps(!); a choice of soft cases, SC-33 for the PB-13 standard battery pack or SC-34 to accommodate the taller PB-14 pack; a filtered cigar lighter plug and cable, PG-3F; a fused power cord and connector for use with external 7.2 to 13.8 VDC power supplies, Model PG-2W; and even a "swivel mount" for using the talkie as a mobile rig, Model BH-6. Good grief—no end of accessories for this little unit.

#### Performance

OK, OK already—how does the darned thing *work*? Like a charm! Its tiny speaker produces room-filling volume, although lack-

**Table 1. Performance Measurements vs. Specifications**

#### Kenwood TH-28A 2 Meter Hand-Held Transceiver

##### Transmitter

Output power with standard PB-13 7.2 v 700 mAH battery pack:

Specified	High	2W	Measured	2.6W
	Med	N/A		2.1W
	Low	0.5W		0.45W
	EL	0.02W		0.02W

##### Receiver

Sensitivity:

Specified	Less than 0.1 $\mu$ V squelch threshold	0.2 $\mu$ V @ 146.000 MHz
	Less than 0.18 $\mu$ V for 12 dB SINAD	0.3 $\mu$ V @ 146.000 MHz

Other characteristics are unspecified, but we measured as follows:

20 dB quieting sensitivity	0.35 $\mu$ V @ 146.000 MHz
	0.35 $\mu$ V @ 138.000 MHz
	1.05 $\mu$ V @ 173.995 MHz
"DFQ" sensitivity (no discernible noise)	3.00 $\mu$ V @ 146.000 MHz
	3.25 $\mu$ V @ 138.000 MHz
	8.75 $\mu$ V @ 173.995 MHz

Aircraft band performance: AM mode

12 dB SINAD	1.80 $\mu$ V @ 118.000 MHz
	0.45 $\mu$ V @ 136.000 MHz

Subband band performance: 438-450 MHz FM

12 dB SINAD	1.05 $\mu$ V @ 438.000 MHz
	1.20 $\mu$ V @ 449.995 MHz

Receiver limiting: Excellent. 50% AM modulation at 400 Hz modulation rate produces zero discernible demodulation, even down to squelch threshold.

Adjacent channel rejection:

For 1 dB desensitization	48 dB @ 15 kHz, 146.015 MHz
Out-of-band desense	114 dB @ 10 MHz, 156.000 MHz

Notation: TH-28A RX "S" meter is a seven-segment LCD bargraph; segments 1, 2 and 3 illuminate individually, but then segments four and five illuminate together, and segments six and seven illuminate together. Thus, the "seven-unit display" really only displays five increments or incremental changes.

##### General

Frequency accuracy: Unspecified. Measured to be +800 Hz @ 146.000 MHz. The "offset" is precise; thus any offset frequency is also +800 Hz. This is bound to vary a bit from unit to unit and will be affected by ambient temperature and age of the unit.



ing great fidelity (an external speaker is a must for serious mobile work), and its internal microphone brings on reports of "wonderful" and natural-sounding modulation from nearly everyone contacted. Once programmed with active, local channels, the little radio is a real pleasure to use. I keep one memory programmed for the local NOAA weather station on 162.550 MHz (available in most parts of the country) and get my WX reports even before the local news stations. Around here, they even report local surfing conditions, real handy for those so inclined. I use another memory set to a CHP (highway patrol) frequency to listen for reports of traffic accidents and routes best avoided until they're cleaned up. (Note: In some states it is a violation of local laws to have a receiver capable of monitoring police frequencies in your car. These "scanner laws" are thankfully being abolished in some states that had them for years, but check to see if it's OK to use a scanning receiver in your area. If it's not and you're caught using one, the rig might be confiscated! Unbelievable, but it's happened.)

Most modern transceivers for VHF-FM (handhelds and mobiles alike) are highly sensitive, but not terribly selective against adjacent-channel or out-of-band interference. This is especially true of those rigs which have wide-coverage receivers that tune beyond the ham-band limits, like the TH-28A. This usually doesn't present a problem when the "talkie" is used with a less-than-zero gain "rubber duckie" antenna, as received signals will never be all that strong, but it can be a pain when such receivers are used with gain antenna systems on the car or at home. As such, I thought it would be important to make some bench tests on the TH-28A to determine just how much rejection it offers to adjacent channels, distant channels, and out-of-band signals. This data is reported, along with other measurements I made, in Table 1.

#### All Things Considered

It should be noted, and I've written this many times, that portable hand-held transceivers were intended to be used that way, and not as permanent mobile or base stations. It is impossible to squeeze full-scale performance into a 15-cubic-inch radio, especially considering that 4-1/2 cubic inches of that radio are consumed by the battery pack, and another 3-1/2 cubic inches are consumed by packaging (case and knobs). This leaves exactly 7 cubic inches for all the radio circuitry! To put this in perspective, a pack of cigarettes has about the same volume (7 cubic inches). Consider that the HT's electronic "works" must all fit completely inside a pack of regular (not extra long, or "100 mm") cigarettes. This includes the frequency synthesizer; memory module; all receiver preamp, mixer and discriminator functions; all transmitter buffer, multiplier, driver and final amplifiers and heat sink; a powerful audio amplifier, speaker and microphone; interconnections; T/R

switching; I/O ports; and controls. It's quite a lot to jam into a pack of cigarettes, and doesn't leave much room for such frills as narrowband helical resonators in the receiver front end, multipole crystal filters in the receiver IF, multiple receive conversion

---

***... it's hard to beat a "handie" for portable/field work, hikes in the woods, camping, biking, skiing, boating and similar temporary exercises, or carrying around at the local swap meet.***

---

stages with "up conversion" to help reduce spurious responses and images, and so forth.

The TH-28A, like most small HTs, gets quite warm during extended transmission periods, running at its normal power level of 2 watts output. It gets bloody uncomfortable when running 5 watts output, and makes me wonder how long it can really last at this power level without failure. HTs were not designed to support long "rag-chews," with stations transmitting for 10 minutes at a time, nor were they designed to replace dedicated mobile units. If your

primary use for a 2 meter rig is mobile operation, then by all means buy a mobile rig. If you want a base station rig for permanent home use, there are plenty on the market to choose from (base rigs are identifiable by their built-in AC power supplies). But it's hard to beat a "handie" for portable/field work, hikes in the woods, camping, biking, skiing, boating and similar temporary exercises, or carrying around at the local swap meet. And they make good temporary mobile rigs in a pinch. (I use an HT in rental cars when I travel out of town. With 2 watts and a "mag-mount" antenna, it's amazing what can be worked.) But just as magnetic-mount antennas are intended for temporary installations, so are handie-talkies. You cannot expect mobile rig or base station performance from a 12-ounce transceiver! If you do, you're bound to be disappointed.

In all, I love the TH-28A. No, it's not perfect. I wish it had fewer high-tech features and more old-fashioned RF performance; but then, I wish the same of every HT I've used. I'd gladly trade 240 memories for some front-end filtering, and I'd be willing to accept a portable that's 25% larger in trade for a triple-conversion receiver with a 16-pole IF filter. But Kenwood knows what they're doing and enjoys a huge worldwide market success. They're appealing to the largest cross section of users, and the TH-28A has a lot of appeal. Not only that, but even my XYL (not a ham, not even close) thinks it's "cute." Can't ask for much more than that.

#### Choosing a Handheld

If you're in the market for a handheld, consider these factors:

- All the modern "talkies" have good transmitters, ranging in output power from 1-1/2 watts to about 7 watts. They sound good on the air. Power output has more to do with battery power available than any other factor, and most HTs will vary in output depending on the battery pack used. In general, the lower voltage but higher current packs will last much longer between charges than the higher voltage, lower current packs will. The difference between 2 watts and 5 watts output is almost inconsequential, so I'd almost always recommend running lower power and using the highest-capacity (ampere-hour rating) pack available. The TH-28A comes standard with the PB-13 pack, rated at 700 mAH, and is an excellent compromise between output power and operating life.

- The primary differences among the various HTs on the market can be found in their receiver performance, features, "standard" accessories, frequency coverage, and ruggedness and reliability. The TH-28A's receive performance is very good, but the "talkies" that cover only the

2 meter ham band and have no extended range (frequency) coverage can be a bit better, since they are more optimized for the 4 MHz they cover. Unfortunately, this trade-off is technology-driven and we can't do much about it without greatly increasing size, weight and price of the equipment.

- I may be crazy, but to test the ruggedness of the TH-28A I put it through a short series of environmental stress tests (which may void the warranty, so I don't recommend you do the same). I have access to mechanical shock and vibration testers, and also 85/85 environmental stress chambers (i.e., 85% relative humidity at 85 degrees C ambient temperature), at my work location. I subjected the TH-28A to shock and vibration as follows: 50g mechanical shock in all three axes with a 10 mS shock pulse width; 50g vibration with rotating polarity; and 85/85 RH/temp testing for 24 hours. The HT worked OK after such stress testing, which is quite severe for consumer electronic equipment, but I had to let it cool down and dry off after the 85/85 test because it wouldn't power up at first. The TH-28A is a rugged piece of gear indeed!

**73 Review**

by Robin Rumbolt WA4TEM

# The XPERTEK DVMS/1+

XPERTEK Electronics  
 P.O. Box 768  
 Lockport NY 14095  
 716-434-3008  
 Price Class: \$349

*Digital voice mail system for repeaters.*

Adding real voice ID messages, voice mail, bulletins, and sound effects to repeaters has been possible for several years now by using circuits and modules that digitize voice and store it in RAM. The only problem has been that either massive amounts of RAM were required, or the message length had to be kept short. Well, the folks at XPERTEK Electronics have changed all that with the new DVMS/1+ Digital Voice Mail System for repeaters.

This system stores digitized voice information on a computer's hard disk at a sysop-selectable rate, thus allowing a tremendous amount of recording time, limited only by the size of your hard disk. A hard drive with 20 meg of free space can hold more than 30 minutes of messages (that's minutes, not seconds!), which is more than enough to hold *Westlink* or a bunch of ID messages. With hard drive capacities now in the gigabyte range, it's hard to imagine not having enough room for all the ID messages anyone would ever want.

Features include time and date voice read-out, user-to-user voice mail, a general bulletin announcement system, a DTMF checker, a

scheduler, a BBS system, and a signal check feature which lets users hear a short playback of their last transmission. Also provided are rotating ID capabilities and an access-codeless autopatch dialing system.

In addition, the DVMS/1+ can interface with the popular RC series controllers from ACC, allowing the repeater controller to trigger various messages and respond to various commands from the voice mail system.

### The Hardware

The XPERTEK system is composed of an interface card kit, a few connectors and cables, software on 11 floppy disks, and a manual. It is not a complete system in itself. The user must supply the following:

1. IBM-compatible computer (80286 CPU or higher is recommended) with at least a 20 meg hard drive, 640K of RAM, an onboard real-time clock, and a 360K floppy drive. A serial port is required to interface with ACC controllers. A modem is needed as well if the BBS features of the DVMS/1+ are to be used.

2. A Soundblaster (trademark of Creative Labs, Inc.) 8-bit audio I/O card.

The DVMS/1+ board serves as the interface

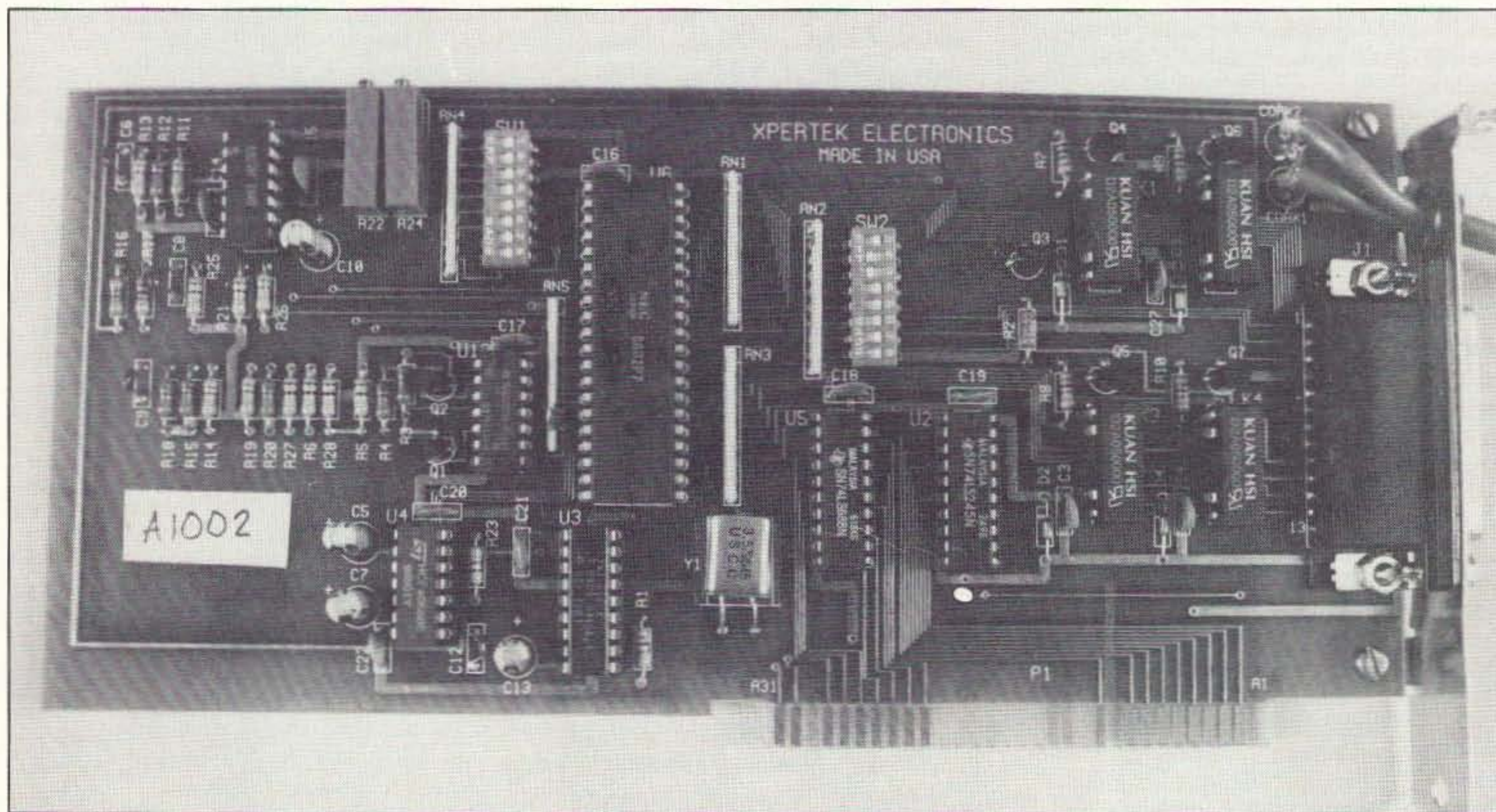
between the PC and the repeater system. It has an on-board DTMF decoder, a multiport interface to the PC bus, four relays for various output functions, and some op amps and transfer gates for audio I/O interface.

Although this is a kit, a complete schematic is not provided; only a partial schematic of the audio input stage is included in the manual. I found this to be such a great shortcoming during installation that I invested the time to trace out the schematic myself. XPERTEK would not provide a schematic.

### Construction and Installation

Construction of the board is straightforward. The board is well-made and silk-screened. The manual provides guidance on which parts to install in which order. It took me only a couple of hours to complete the board, and it worked the first time.

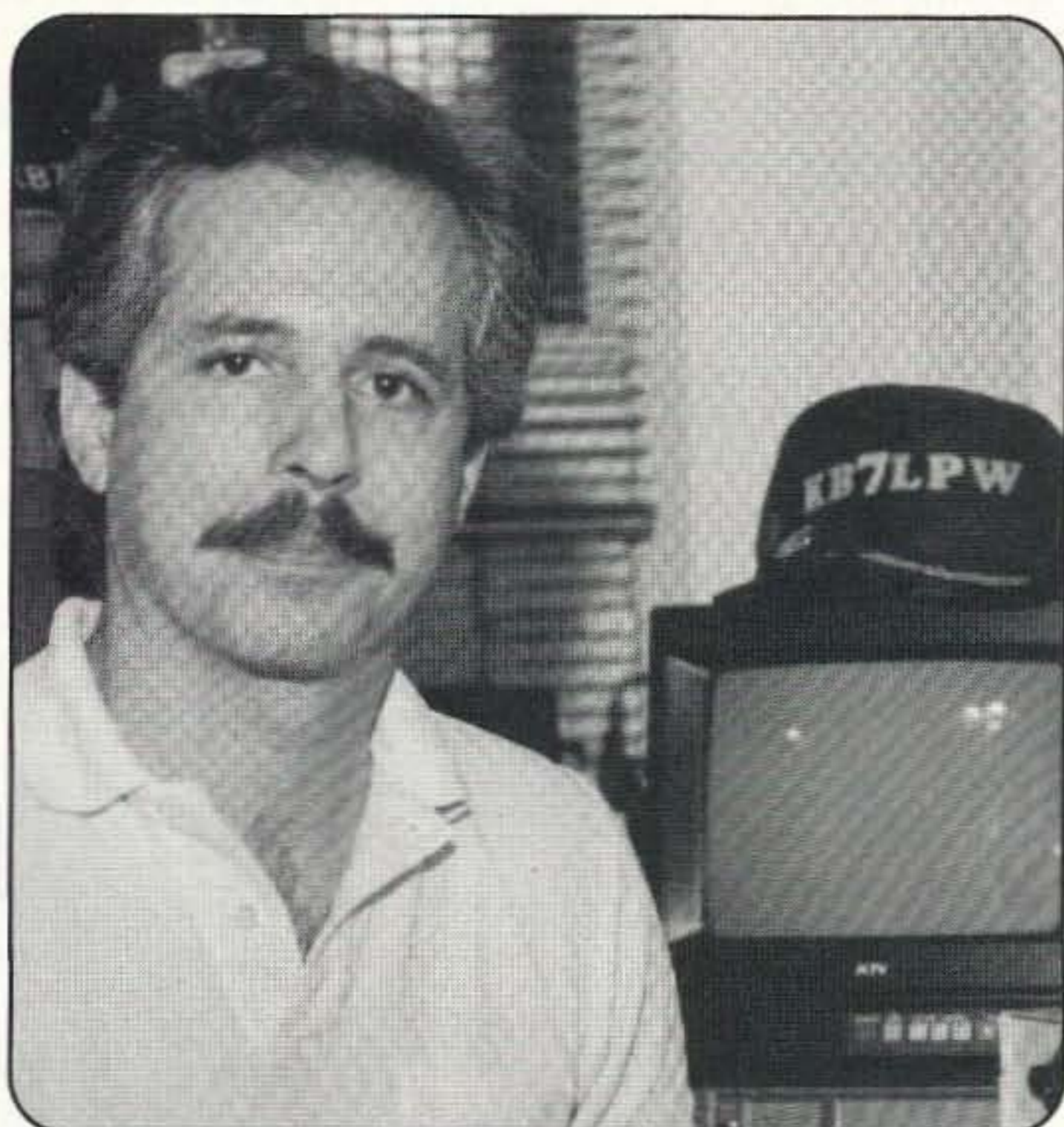
Installation was a bit more difficult. It took a few trips to the repeater site and several calls to XPERTEK to get it right. Taking advantage of all the features of the DVMS/1+ requires making audio and logic connections to inputs and outputs of our RC-850 controller, connections to the main and control receivers and the



The XPERTEK DVSM/1+ digital voice mail system.

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transmitter, and connections to the Soundblaster board and the computer's serial I/O card.

The DVMS/1+ manual attempts to tell you what each I/O pin connects to, but some of the descriptions are ambiguous, not really telling if the pin is an input or output. It was here that my traced-out schematic was invaluable. I even found some non-fatal design errors on the PC board which XPERTEK said would be corrected in its next generation of boards.

Software installation was quick and pain-free. Although there are 11 diskettes full of software to be loaded, the "Install" program makes it quick work. The software takes up about 10 meg of space on the hard drive.

### Operation

All operations of the DVMS/1+ are prompted by a pleasant female voice, which I understand belongs to a lady named Kathy from upstate New York. She asks for user numbers and passwords, and even directs you when to talk.

The voice mail system accommodates up to 1,024 users, each with a unique user number and a user-configurable password. User access can be individually enabled and disabled for maximum control. The system works fine, but takes many digits to operate. On our repeater it takes at least eight digits just to turn on the voice mail system. Then the user must enter commands for the functions he wishes to activate.

These lengthy codes are only needed for voice mail and bulletin functions. All other

functions are lumped into what is called "Direct Access," meaning that no lengthy access code or password is required. The sysop does have the option, however, to impose password protection on any function.

One really nice sysop feature of this system is the ability to make the access and command codes anything the sysop wants them to be. There are no preprogrammed prefixes that are cast in concrete. The system comes with default codes for everything, but they are easily changed. That's really nice.

The general announcement system is available to all users so that anyone can post an announcement for all to hear.

The DTMF checker and time and date functions are standard fare on repeater controllers nowadays, but it's really nice when the voice gives you the day of the week and the name of the month as well. There are several options available to customize these readouts.

A feature that has proven most popular on our repeater is the signal check feature. This allows users to replay a few seconds of their last transmission to hear the quality of their signal into the repeater.

The scheduler makes it possible for the system to send control codes to itself and to the repeater controller at preset times. It adds capabilities not available on the RC-850 scheduler. We can even use it to dial the telephone automatically and download data.

The BBS system allows limited control of the PC via modem, including reading directories and file manipulations. All functions of the DVMS system can be accessed via the mo-

dem. Messages and files can be uploaded via modem to avoid squelch tails and radio noise. You can even send commands to your repeater controller via modem and the DVMS/1+ system.

The access-codeless autopatch dialer system enables the sysop to build a file of permitted telephone prefixes. Then when a user wants to make a call, he simply dials the phone number desired. The DVMS/1+ checks the prefix. If acceptable, it sends the correct autopatch "ON" code and telephone number to the repeater controller, commencing the call.

This system was harder to install than necessary due to difficulty with the manual and the initial lack of a schematic.

We experienced some crosstalk problems due to running various audio signals through the same multiconductor cable supplied with the kit, but this was easily solved by running separate cables.

When the computer first boots up, the DVMS/1+ holds the transmitter on the air until its hardware initialization program is successfully run. If it doesn't run successfully, your transmitter is locked on the air!

The DTMF decoder on board the DVMS/1+ has different characteristics from the decoders in our RC-850, even when fed from the same audio source. Consequently, we had to do some audio level and frequency response tailoring to get it to decode as well as the RC-850.

This system will work with an old XT computer (80286 and above is recommended), but

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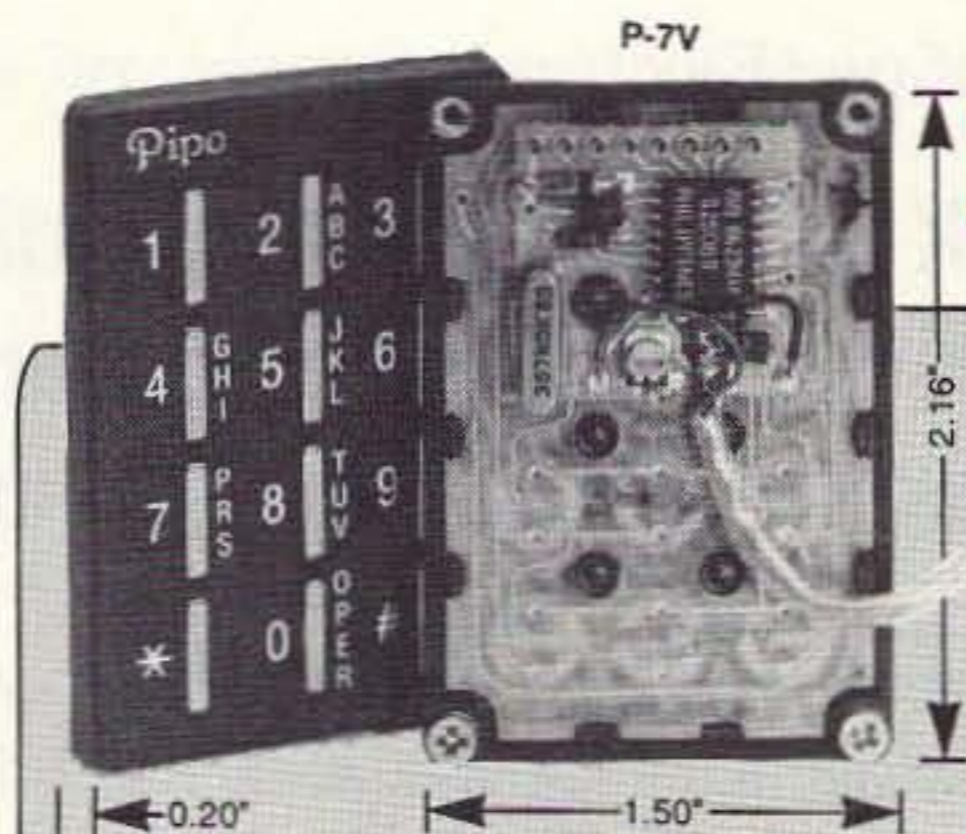
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it will be too slow to be useful. We recently upgraded from a 286 12 MHz system which exhibited short (less than one second) delays, to a 33 MHz 386 SX system. Changing the motherboard did not make that big a difference. However, changing from a 20 meg 65 ms hard disk to a 50 meg 20 ms hard disk made a tremendous difference. Responses are now instantaneous.

*Do not add this system to your repeater unless you have a way to remotely control power to the PC! This is an absolute must!*

Although a watchdog timer pulse train has been provided in the most recent software upgrade, implementation of the watchdog timer hardware is still left to the user. A future hardware release will no doubt incorporate a watchdog timer circuit, but at this time it is not available.

XPERTEK is a garage-shop operation. Its proprietor, Andy Mill, only wears his XPERTEK hat on nights and weekends. If you call, chances are you'll almost always get his answering machine or his "secretary." Funny, but he doesn't use a voice mail answering system!

#### On the Plus Side

There have been several software upgrades since we purchased the system which have virtually eliminated all software bugs, and have made some of the features easier to use.

Despite initial misgivings about having a PC at a remote mountaintop site, we have gone through one cold winter, one lightning season, and one very hot summer with few PC-related

problems. The only lightning-related PC damage has been to the modem, resulting from a direct hit which severely damaged much of the rest of the equipment. The DVMS/1+ was not affected.

The DVMS/1+ creates a daily date-time stamp log of all DTMF tones it decodes, which is more versatile in some ways than the same

**"These things have made our repeater the one to listen to in our area. Membership in our repeater club has jumped substantially since the system was added."**

RC-850 function. It will store every digit it decodes, not just the ones that activate functions, although it does also show which functions have been activated.

While I mentioned that telephone support was intermittent, I must also say that when you do make contact with Andy Mill, he'll go the extra mile to help work out problems. He has spent a great amount of time on the phone helping to get our system operational.

If you want to customize some of the system's prompting messages, that is easily done, too. We have Jack Nicholson doing some of our prompts now!

#### Conclusion

The DVMS/1+ affords us the capability of having a great variety of ID messages, sound

effects, and humorous one-liners that pop up unexpectedly at the most opportune moments, all without worrying about how much memory is left. We have used the system for meetings, hamfests, and net announcements. Various users have posted "equipment for sale" and "equipment wanted" announcements. Local PC user's group and astronomy club members, who are also hams, have posted their meeting announcements. We occasionally run an announcement inviting non-hams interested in becoming hams to call a certain phone number for information on how to get into amateur radio, and we've received many calls from scanner listeners as a result. We have posted "Elmer" bulletins to help new hams as well. Any repeater club member can post a bulletin without control op assistance.

These things have made our repeater the one to listen to in our area. Membership in our repeater club has jumped substantially since the system was added. I believe that soon no advanced repeater will be without such a system—and this one is reasonably priced!

A future software release will allow the scheduler to execute script files, which will allow such things as middle-of-the-night automatic dial up and recording of *Westlink* for user-requested playback at a future time. This software has been under development for some time and may be ready for release by the time this review is published.

After working on and with the DVMS/1+ system for a year now, would I buy it again? In a heartbeat! I can't imagine our repeater without the capabilities this system affords. 73

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# RTTY LOOP

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Marc I. Leavey, M.D., WA3AJR  
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Baltimore MD 21208

Here in Baltimore it's cold, snowing, and not really a nice day to be outside. So, if it's nasty where you are too, why not look at some of the things you can do over a warm radio? Over the recent past, I have been offering several disks of RTTY programs. Many of you have requested more information on these collections. This month, let's have a look at Disk #4 of the "RTTY Loop" Software Collection.

Before we delve into the programs, a word about shareware, freeware, public domain, and the like. Except for the first term in that list, many such programs are free and in the public domain. This means that you may feel free to use them, or throw them away, or modify them, at your pleasure. Many of the "free" programs carry a copyright notice, which means that you cannot claim authorship or nominally incorporate them into a work which you then call your own, but at least the price is right.

Shareware is a different story.

When you acquire a shareware program by downloading it from a bulletin board, getting it on a disk from a software vendor, or receiving it as part of the "RTTY Loop" Software Collection, you have not bought the program. You have obtained a copy to try out and, if you like it, you are requested to send the author the remuneration requested in the documentation. This honor system, "try before you buy" software, works quite well, and is the preferred system of distribution for many fine amateur radio products.

All that aside, there are seven programs in the current edition of Disk #4. They encompass a wide range of RTTY, DX, packet, and AMTOR capabilities. A brief synopsis of each program may help bring this into focus.

### DXER13.ZIP

Written by WA6JOO to gain experience in QuickBasic programming, DXer is a versatile amateur radio program primarily of interest to the HF DX operator.

As he puts it, the DXer concentrates several functions of interest to the serious DXer into one (hopefully)

easy-to-use program:

- Bearing and distance from transmitter to receiver. Path ends may be selected by latitude-longitude, grid square, prefix, or by browsing through the data base.

- Sunrise and sunset times for any location.

- Maximum usable frequency and frequency of optimum traffic between any two locations.

- A listing of all locations sharing a common terminator line (Gray Line).

- Custom printing of bearing/distance charts for any location.

- A grid locator function using either six-digit or four-digit coordinate system.

- A complete data base of all ARRL countries, as well as other locations around the world. The data base shows latitude, longitude, continent and CQ zone of each location. Entries may be easily added, deleted or edited.

The program is released for personal use, and a contribution of \$10 to the author is requested, if you feel it is of use to you.

### FAXFRQ.ZIP

This is an informational file, with lists of HF frequencies of news and WEFAX stations monitored. It was accurate when compiled, but this information is always changing. However, it's a good starting point for monitoring.

### PHS300.ZIP

PHS, Version 3.00, is a host mode server program for the PK-232 written by Peter H. Heinrich HB9CVV. It provides a variety of features, including:

- Support of packet, AMTOR, RTTY, ASCII, Morse and signal modes.

- User configurable com-port, colors and texts.

- Split-screen operation.

- Command and parameter entry in mode sensitive dialog windows.

- Extended help functions.

- Review of received text (backscrolling).

- Printing and snapshotting the review-buffer.

- Logging (capturing) to file.

- Online printer support.

- Send text from file.

- Binary file transfer using YAPP protocol (packet mode).

- Multi-channel operation (packet mode).

- Heard list showing the path (packet mode).

- Net/ROM frames are decoded (packet mode).

- Word-wrapping is available (packet mode).

- Temporary exit to DOS.

- Built-in message editor.

- Support for screens up to 80\*60.

- 16550A chip support with FIFO.

The program is free; the author requests only your comments on his work. This is a comprehensive pro-

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## HAM HELP

Number 13 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Where can I send to get an "Operational Manual" for my HALLICRAFTERS Model SX99 Receiver? The manual is very important to my operating and maintaining this equipment. Frank W. Arnold, 1215 Sullivan Ln., #82B, Sparks NV 89431.

I am looking for info regarding the SBE (Sideband Engineers) Model 33 80-15 meter transceiver; operation and service manuals, mike wiring diagram, and modifications. Thanks! David Colburn AA1FA, 130 Essex St., S. Hamilton MA 01982. Tel. (508) 468-2199, Ext. 328; or packet @ K1UGM.

RADIO Lost or Stolen in the US Mail: A 2 meter ICOM Model IC-2SRA Transceiver; Serial #03304. Marked with call K1UXD. A well-marked priority package has not arrived at its intended destination. Reward for return. Thank you. Paul F. Kelly, 135 East Main St., #V8, Westborough MA 01581-2741 USA. Tel. (508) 898-3202.

NEEDED: The schematic for a HAL-LICRAFTERS HT-32 transmitter, about 1958 vintage. I'm anxious to get it back on the air. Al Smiley K8NOV, 9970 Page Rd., Marlette MI 48453.

NEEDED: Information on schematics, programming, and re-tuning of KENWOOD TK-801S down to 440-450 MHz. Also looking for 6m SSB/FM and other VHF/UHF equipment and KENWOOD TR-751A accessories to swap for computer parts and equipment. Thanks. Rob Bellville N1NTE, P.O. Box 892, Northboro MA 01532.

I am a newly licensed Technician and am interested in obtaining information about using Repeaters in my area. Ray Chase N1QFF, Mt. Peg Rd., Woodstock VT 05091. Tel. (802) 457-4084; FAX: (802) 457-4517.

WANTED: Schematic and/or manual for PRECISION Apparatus Model E-200-C Signal/Marking Generator (copies ok); RCA Receiving Tube Manual (preferably late 60's-70's edition). Chet Smith WB2LUQ, R.D. #1 Box 30, Verona NY 13478.

WANTED: Manual or copy of HP1707B HEWLETT PACKARD 75 meg scope. I will pay copying fees ets. Mike N4BME, (804) 564-8821.

gram, which has been ported to OS/2 as well, and seems quite capable.

#### PKTGOLD.ZIP

PktGOLD is another multimode controller for AEA TNCs. This is a test drive of InterFlex Systems Design Corporation's versatile control program. It enables control of packet, RTTY, AMTOR, and other modes of the AEA series of controllers.

The test drive is functional, but it comes with minimal documentation. It is free, and may be circulated at will. Full commercial versions of the program are available from the authors for \$79.75 for the Enhanced version, and \$59.95 for the Multimode version.

#### PKTWIN11.ZIP

Written by Paul M. Hounslow, PktWin is a Windows-based controller for packet controllers. The controller is connected through the computer's com port, and modes and features configured via the program.

With many of the switches set in an INI file, this is an economical, versatile program. No payment is requested by the author.

#### TUWIN.ZIP

Discussed last June, TUWIN was written by Wayne E. Wright W5XD, and designed as an accessory to the WriteLog Windows logging program to

allow Windows-based logging and RTTY for contesting, as well as general operations. TUWIN works with old-style RTTY terminal units, like the HD-3030, MFJ-1229, or HAL ST-6, that do not do internal Baudot-to-ASCII conversion. It thus should not be used with multimode controllers like the PK-232 or KAM. With a split-screen display, text to be transmitted is entered into the lower window, received text is displayed in the upper window.

The program uses the DTR and RTS lines on the serial port to indicate "transmit," with the lines being keyed

designed to reduce the overall "learning curve" normally associated with this type of product.

XPCOM was written originally for the MFJ-1278; however, it has also been structured to work with the AEA PK-232. Operation of the PK-232 has been optimized to use AEA's HOST mode.

XPCOM offers the following features to simplify operation for the user:

- Pull-down menus.
- Custom operation with the AEA PK-232 and MFJ-1278.
- Dual-TNC support.

***"Overall, this is a neat, if bare-bones, approach to using an older terminal unit on RTTY, with a spiffy Windows display."***

about 500 mSec before the first character is sent, and continuing until about 500 mSec after the last.

Overall, this is a neat, if bare-bones, approach to using an older terminal unit on RTTY, with a spiffy Windows display. Again, this is a freebie!

#### XPCOM1.ZIP

Gary Johnson KF7XP has his name on XPCOM, a program written to fill a void that has existed in commercial software for digital communications. The user interface has been

- Mouse compatibility.
- One-key brag file and text operation.
- External interfacing to the user's favorite text editor.
- Offers full packet, AMTOR, FEC, FACTOR, BAUDOT and CW modes.
- Full use of the HOST mode for the AEA-PK232.
- Simplified command structure for the MFJ-1278.
- Multi-connect operation with XP Windows.
- Intuitive on-line help system.

- Quik-connect feature for packet.
- Auto-route capable through brag text.
- Real-time and background printer support.
- Multiple ASCII file transfer in packet mode (AEA only).
- Built-in logging, with AutoSearch.
- Macro support.

XPCOM is classic shareware, with the author requesting that if, after trying the program for no more than 30 days, you choose to use the program, you register it with him for the sum of \$39. Still, this is quite a bargain.

So, these are the programs in the "RTTY Loop" Software Collection, Disk #4. If you would like to obtain a list of programs included in these collections, send a self-addressed, stamped envelope to me at the above address, or Email on CompuServe (75036,2501), Delphi (MarcWA3AJR), or America Online (MarcWA3AJR). The collections themselves may be had by sending a 3.5" high density (1.44 Mb) disk, or equivalent capacity in smaller disks, for each collection; a stamped return mailer; and \$2 for each disk to be filled, to the address at the top of this column.

Next month we'll take a look at what some of you have had to say lately. Who knows, if you write today, it just might make it into the column before summer! Stay warm, and see you next month.

73

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## Some Miscellanea

Every now and then I like to take a few potshots at those topics that reader mail indicate are of interest to you, but that requires less than a whole column's worth of discussion. This month we will take a look at a couple of circuits that fall into that category. You might find them interesting.

Before going on, however, let me reiterate that my printed circuit boards for the MAR-1 preamplifier are still available for \$7. You can get them either from me directly (P.O.Box 1099, Falls Church VA 22041) or from FAR Circuits (18N640 Field Court, Dundee IL 60118). FAR makes boards for most 73 projects. I also have some MAR-1 chips left, which sell for \$4.95 each, or alternatively, I'll send you both the MAR-1 and the printed circuit board, plus either 100 pF or 1,000 pF chip capacitors, for a total of \$10. I'll keep the offer open while supplies last.

Let's take a quick look at two different circuits: first, an active bridge amplifier for Wheatstone bridges and differential output RF bridges; and second, an audio notch filter.

## Bridge Amplifier

Many bridge and other measurement circuits have balanced or differential outputs. That is, the output is not single-ended, which is a voltage measured with respect to ground, but is floating. A differential output has two floating lines, and the output voltage is proportional to the difference between the voltage appearing between each line and ground.

Figure 1 shows a circuit for an output meter that will serve as the output for such a bridge. Amplifier A1 is an operational amplifier connected in the DC differential amplifier configuration. Provided that  $R1 = R2$ , and  $R3 = (R4 + R5)$ , the output of this circuit is:

$$V_o = V_2 - V_1 \left( \frac{R_3}{R_1} \right)$$

In the specific configuration shown in Figure 1, the gain ( $R3/R1$ ) is unity (1), so the circuit is relatively insensitive. By increasing  $R3$ ,  $R4$  and  $R5$  by a factor of 10, you can get a gain of 10, or increase the components by 100 and the gain goes to 100.

A signal output voltage is provided to the "rest of the world" through J1. In most cases, J1 will be an RCA phono jack or a BNC chassis-mounted "RF" style connector. The alternate output is a zero center 100  $\mu$ A (up to 1 mA

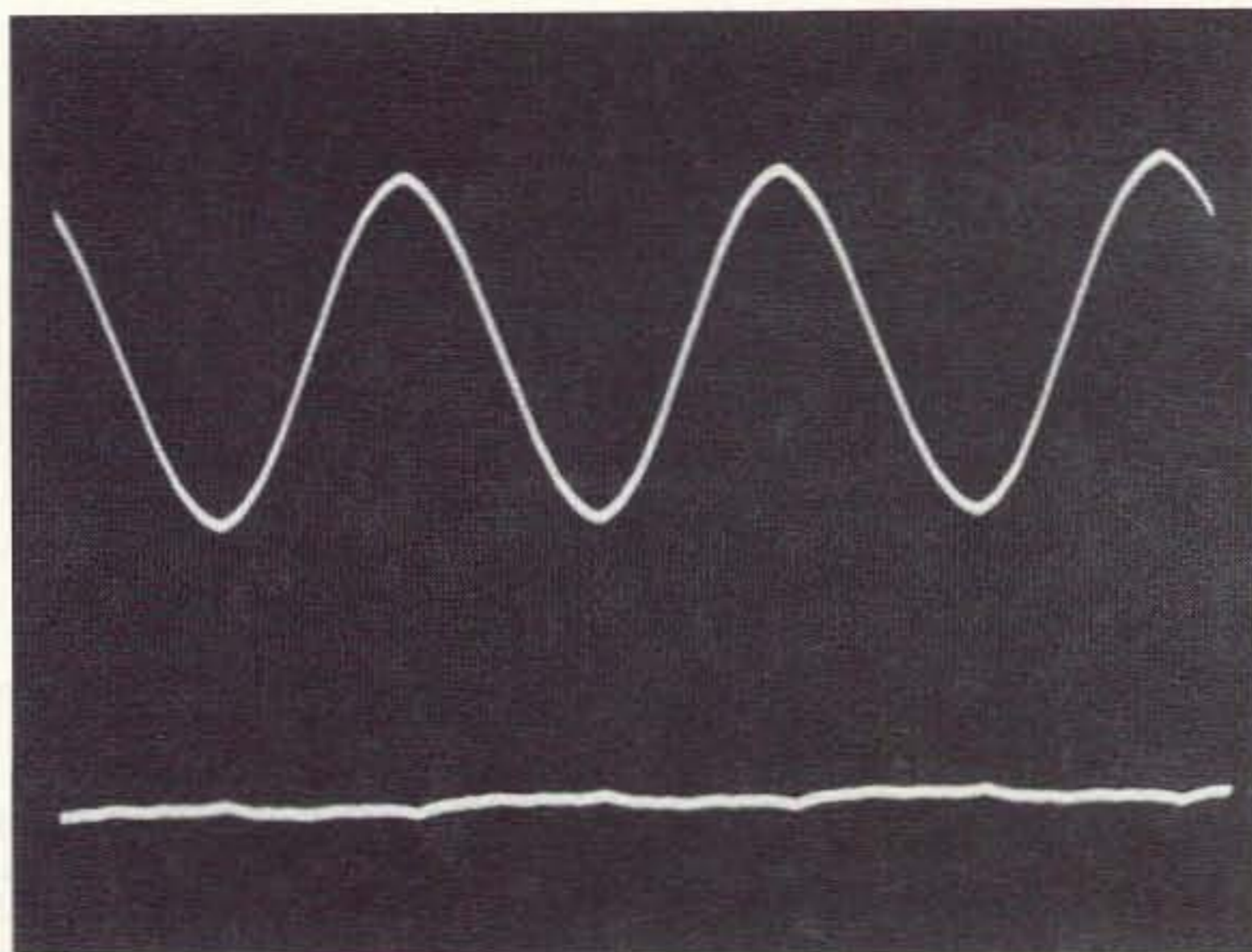


Photo A. Oscilloscope trace showing input and output of the notch filter (49 dB attenuation).

can be used) DC microammeter. Potentiometer R6 is a sensitivity control that permits adjusting the deflection of M1 without varying the bridge circuit.

Amplifier A2 is a buffer amplifier to isolate the light emitting diodes, or LEDs (D1 and D2), that serve as a visual output indicator. Two LEDs are selected that have approximately equal output levels. To select, connect both diodes such that each is in series with an 820 or 1,000 ohm resistor. Connect them across a 12 volt DC

power supply so that both are illuminated. If both diodes are approximately the same brightness, then use them. Otherwise, swap out one of the diodes with others (LEDs can be bought in bulk) until a match is found.

When connected into the bridge amplifier circuit, D1 and D2 are opposite in polarity. Diode D1 will light up when the output of A2 is positive, and D2 will light up when the output of A2 is negative. When the voltage is zero, neither lamp is lit. As a result of this

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Detailed literature upon request. Prices: Base communications package with AMTOR, RTTY, CW and QSO/callsign logging database \$95. Base + Pactor \$145. Extended audio package adds Audio Spectrum Analyzer, HF WEFAX and SSTV reception. Base + Extended \$140. Base + Pactor + Extended \$175. Pactor alone \$50. PK232 Adapter \$49. Shipping \$3. VISA/MasterCard accepted.

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feature, the illumination will let you know when the bridge supplying the input signal to A1 is in balance ( $V_2 - V_1 = 0$ ), or in which direction it is unbalanced.

I've used this circuit on a number of instruments and found that it works well. The illumination of the LEDs drops off smoothly until a point very close to null is reached. However, don't even think about using it in sunlight. Under outdoor conditions you probably won't see the LEDs when they are fully lit (remember those mid-1970s calculators and digital watches with the LED readouts?).

The active devices are operational amplifiers. I've used 741, 1458, CA-3140 and CA-3240 devices for this circuit. The 1458 and CA-3240 devices are dual op amps, so only one is needed to accommodate both A1 and A2.

The DC power supply connections are not shown, but each device needs V- and V+ DC power supplies (unless a dual op amp is used, in which case only one connection is needed for each V- and V+).

#### Audio Notch Filter

A notch filter is a band reject filter; i.e. it rejects a narrow band of frequencies around the center frequency. Several uses are made of the notch filter. CW buffs sometimes build two types of filters. A high-Q band pass filter will pass only the 400 to 1,200 Hz signal

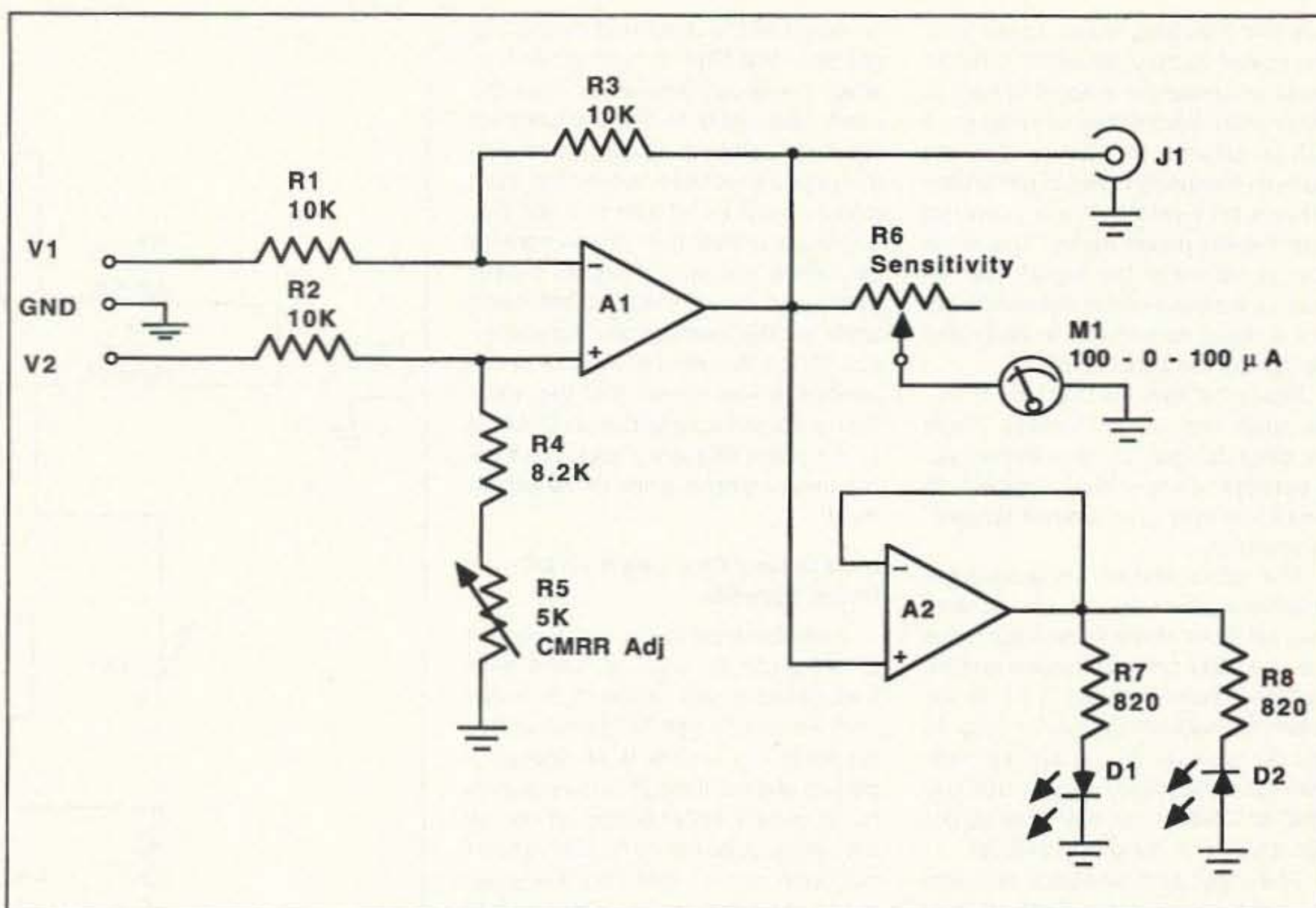


Figure 1. Bridge null voltmeter/amplifier.

that you desire to copy. A notch filter, on the other hand, will reject the design frequency, so it can be used to eliminate unwanted interfering signals. For example, you might design a

bandpass filter to pass, say, 800 Hz (or whatever is comfortable for you), and a notch filter to take out 600 or 1,000 Hz. Interfering signals could then be attenuated even further than

the slope of the bandpass filter indicates.

Another use for the notch filter is to reduce the 60 and 120 Hz hum in the output of audio amplifier circuits. You

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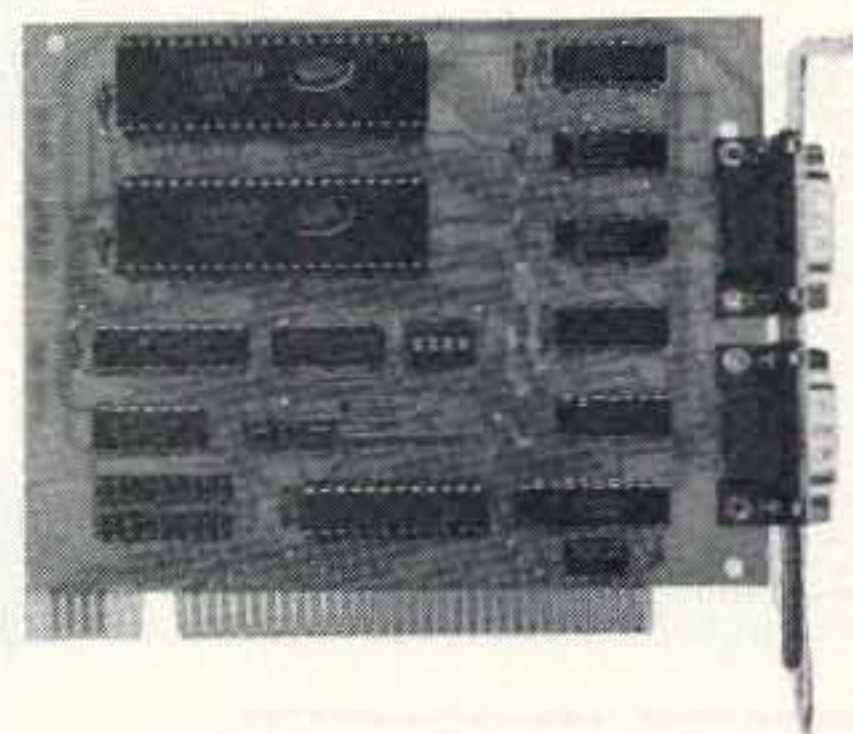
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may find that long leads, noise from the power supply, or other defects cause an unwanted amount of hum in either your transmitter or receiver. I built an active notch filter to eliminate the hum frequently heard in direct conversion receivers that are powered from the AC power mains. The notch filter is placed in the signal line between the output of the detector/mixer of the direct conversion receiver and the input of the audio amplifier.

Figure 2 shows the circuit for a simple notch filter that is tunable. There are other designs, but they require dual potentiometers or dual capacitors to tune them over even a small range of frequencies.

The active devices are operational amplifiers. You can use any op amp that will work at the frequency range you need. For communications purposes (F less than 3,000 Hz), a 741 is sufficient; a 1458 will suffice for both A1 and A2 because it is a dual op amp. For higher frequency ranges use CA-3140 or CA-3240, or any other device with a high gain bandwidth product.

The input and feedback resistors are not too critical, but 250k ohms to 2.2 megohms are recommended. What is necessary, however, is to make  $R_1 = R_2$  and  $R_3 = \frac{R_1}{2}$ .

The notch frequency is found from:

$$F_o = \frac{1}{2\pi \sqrt{R_a R_b C_a C_b}}$$

For a 60 Hz notch filter, good values to start with are 124k ohm for  $R_a$  and  $R_b$ , 1,500 pF variable for  $C_a$  and 1  $\mu$ F for  $C_b$ . Scale these values downwards for higher frequencies, using the above equation as a guide.

Photo A shows an oscilloscope pre-

sentation of the input and output signal from the filter at resonance (i.e. when the input frequency is at the notch frequency). In the filter used for this test I used the 60 Hz version and the values described above. The input signal (upper trace) was a 1 volt p-p, 60 Hz signal from my function generator, while the output signal (lower trace) was barely visible at the same scale on the oscilloscope vertical input. When the vertical input was expanded, it was shown that the notch filter produced an attenuation of 49 dB at the notch frequency, plus or minus the measurement error of my equipment.

#### NiCd Battery Charging from DC Power Supplies

A reader wrote to me and asked if it is possible to charge hand-held transceiver nickel-cadmium batteries from +6 or +12 volt DC bench power supplies. The answer is an unequivocal yes and no. If the DC power supply has a current limiter control as well as a voltage output control, then yes; if not, then no . . . don't try it without special knowledge. The procedure is simple:

1. With the current limiter all the way on (zero output current), and the voltage set to about a third of the battery terminal voltage, short-circuit the output of the supply and then slowly increase the current to a level that is 1/10 of the ampere-hour rating of the NiCd battery; i.e. if you use 500 mA H batteries, then set the short-circuit output current of the supply to 50 mA.

2. Remove the short circuit, and increase the voltage output of the DC power supply to the exact potential of a fully charged battery (see instruc-

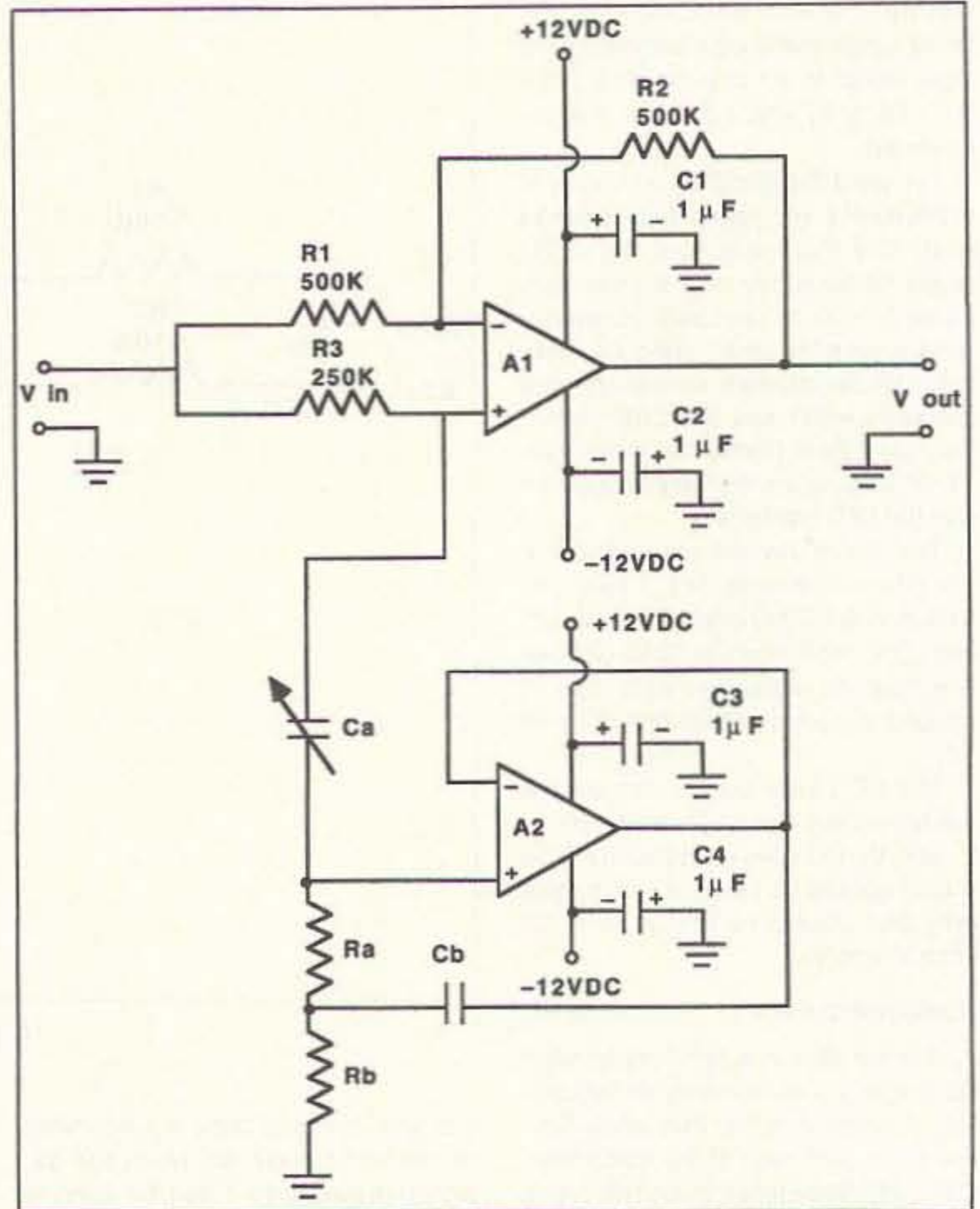


Figure 2. Audio notch filter circuit.

tions for the particular battery pack).

3. Connect the battery to the supply, being careful to observe polarity. Charge at 1/10 level for 14 hours.

The battery can blow up if charged too rapidly, or if too high a voltage is

used. That's why the current limiter and output voltage adjust controls are needed. I prefer to place the battery in a small wooden box to prevent "shrapnel" in case the battery does blow up. Good luck and work safe. 73

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## Radio Direction Finding

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### Texas T-Hunters Trap Teen Thief

"Every ham needs a basic understanding of the principles of transmitter hunting." That's what I tell ham clubs and convention forums in my talks on radio direction finding (RDF). Of course I hope that when I'm finished, everyone in the audience will want to try friendly RDF competitions (usually called foxhunts or T-hunts). These events add to the camaraderie of our hobby while teaching useful propagation and electronics skills.

But even if you never set out to find a radio fox, you will probably find RDF techniques useful in your future ham experiences. Perhaps you'll want to join a chase team for a high altitude ham balloon launch, or find an annoying source of interference, such as a noisy thermostat or cable TV leakage.

### Dallas DF Detectives

When someone's transceiver is stolen or there is a stuck carrier on your local repeater input, you'll be

ahead of the game if you have already assembled and installed some mobile RDF gear. You will be even better off if you have accumulated some T-hunt experience. Tom Lewis AB5CK proved this a few months ago when he used his RDF skills to foil a young radio thief.

AB5CK regularly goes T-hunting in the Dallas/Fort Worth area. "My friend Randy Harlin AA5WJ teaches music at a middle school," says Tom. "He is also the owner and operator of a 2 meter repeater, which he likes to monitor with a dual-band handheld at work. One day the HT was stolen off his desktop. The taker apparently had little knowledge of ham radio and was unaware of how to change frequencies. Before long, there was a rash of profanity over Randy's repeater. He called me that evening.

"We speculated that the unlicensed profane operator was the student/thief," Tom continued, "and we guessed that he might make additional transmissions the following day after school. To speed up the process, I asked Randy who could have done it. I got the names and addresses of his primary suspects, then centrally locat-

ed myself in my car outfitted with T-hunting gear."

Sure enough, the profane transmissions started again shortly after school let out. Tom quickly got a bearing. "Bingo! From the bearing, I knew it was probably one kid, so I drove straight to his apartment building. I drove around the property while he was cussing, and the RDF antenna just kept pointing right at one window. He was using a subdued voice so family members would not hear the profanity."

Luckily, Tom was not spotted by his target as he circled the area. Once he was sure that he had the right residence, he made a transmission saying that he was out front and that the radio must be returned. "To our surprise, the thief complied," says AB5CK. "This eliminated the need to have the authorities search his home. We couldn't have been luckier!"

So AA5WJ's rig was quickly recovered. Tom left disciplinary action to the school, but he is sure that the incident was not treated lightly. Of course, stories such as this don't always have a happy ending, but it pays to be ready. Plan now, as there is no time to build your gear once a bootlegger or stuck carrier is on the air.

### An Improved Bug Buster

Regular readers will remember an LED-readout "sniffer" project in the July and August 1990 "Homing In" installments. This hand-held field-



Photo A. At 4.1" x 2.4" x 0.8", the Optoelectronics model R20 field-strength meter fits into a shirt pocket.

strength meter (FSM) detects and shows the level of nearby RF from 10 to 2500 MHz. Teamed with a beam or quad for the frequency of the hunt, it will guide you on foot to a concealed fox, once you get close enough to pick up a few millivolts of signal.

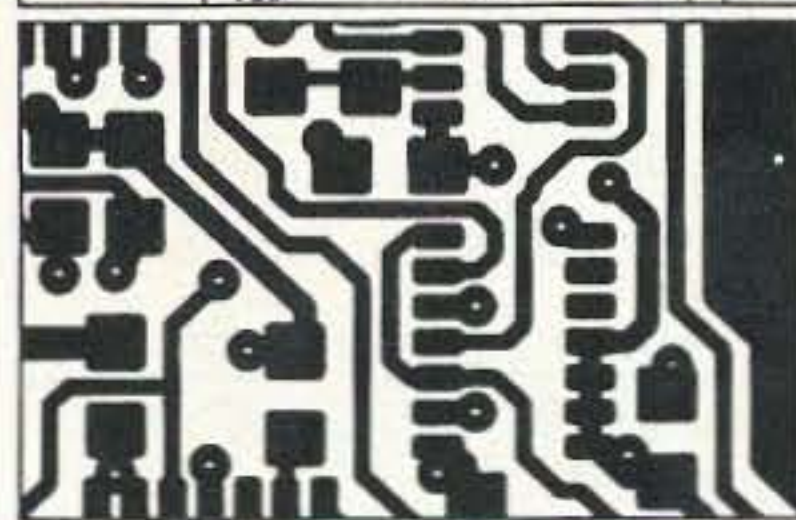
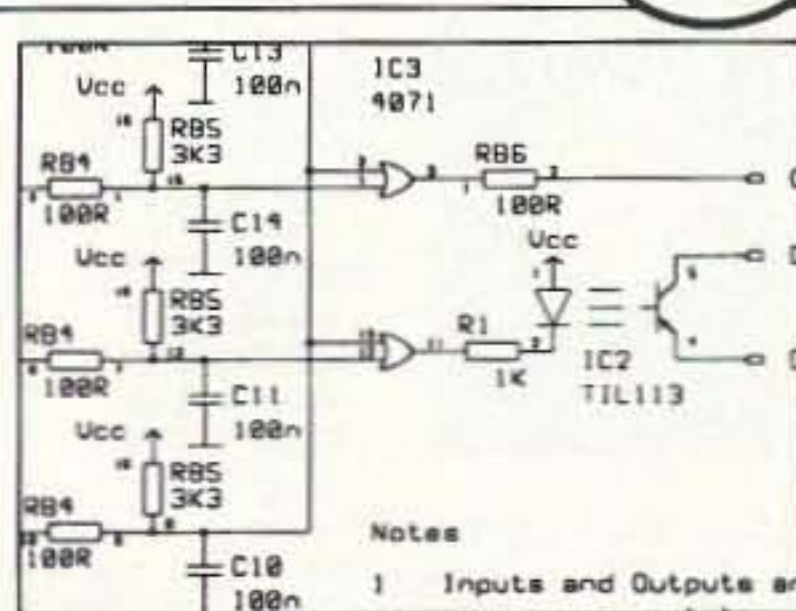
That 1990 project uses the circuit board from the Optoelectronics Model CCB "bug detector," which features a pair of monolithic wideband RF ampli-

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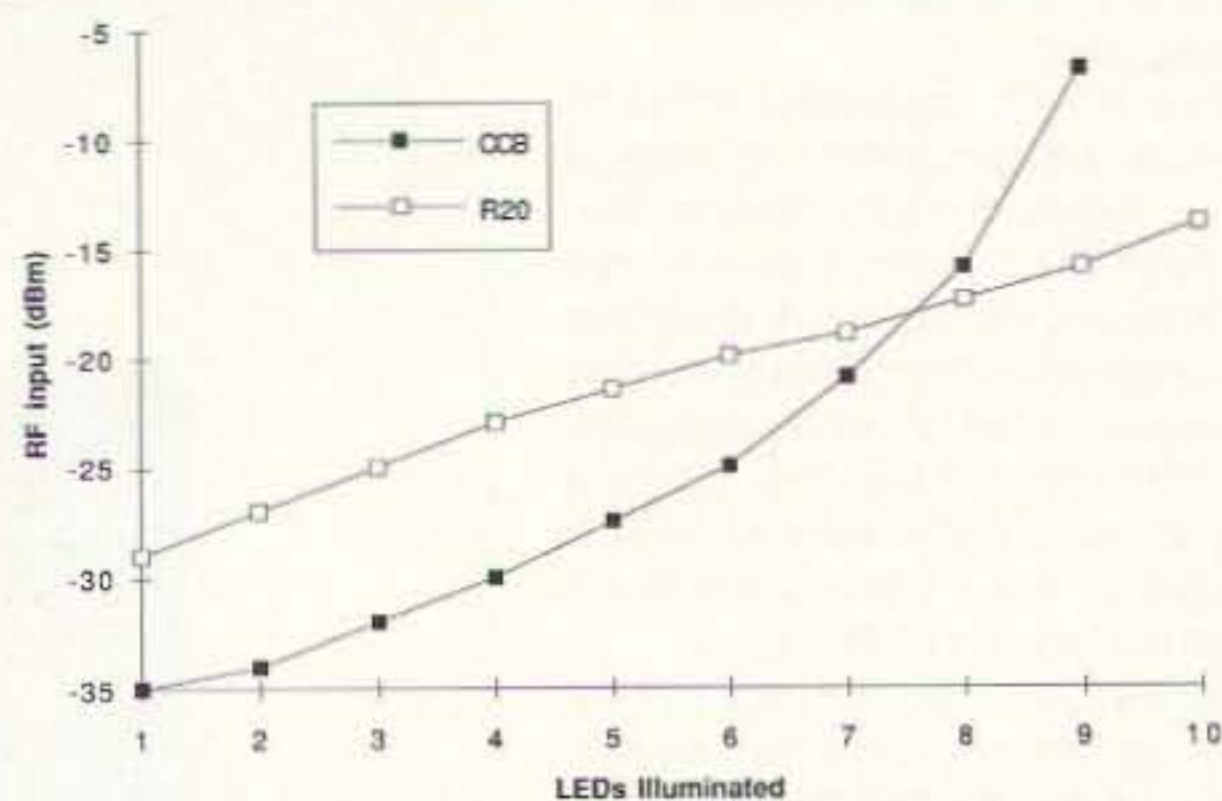


Figure 1. Measurements by KOOV of input RF levels for each of the 10 LEDs at 2 meters for both the CCB sniffer kit and the factory adjusted R20. The -29 dBm R20 threshold corresponds to 8000 microvolts across 50 ohms.

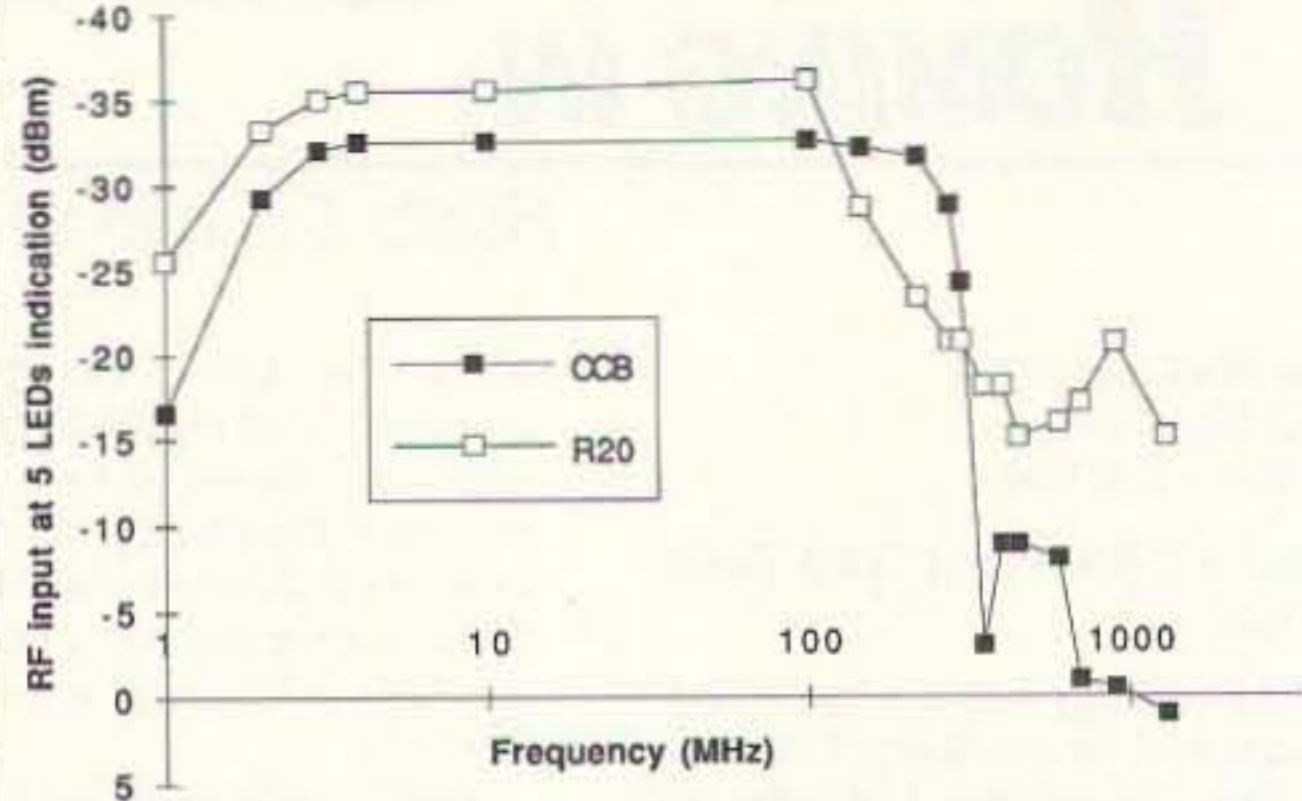


Figure 2. Measurements by KOOV of sensitivity versus frequency for the CCB and R20 at 146 MHz. The -36 dBm input level at HF and low VHF corresponds to 3500 microvolts across 50 ohms.

fiers and a bar graph display. With an upgraded voltage regulator and enclosure, the project cost about \$70 to build.

Recently, Optoelectronics Engineering Manager Bill Owen KD4HGT enhanced the CCB circuit, shrunk it to pager size, added amplitude modulation detection, and renamed it the R20 AM Interceptor, shown in Photo A. With surface-mount technology and chip components, it has a dramatic improvement in UHF and microwave sensitivity.

An LM3915 logarithmic bar graph IC drives the display, so each successive LED represents approximately a 2 dB increase in signal strength (Figure

1). This helps you guess your distance from the transmitter. If you don't like the factory settings for zero and full-scale RF levels, you can modify them by tweaking two internal controls.

Using the supplied non-resonant R20 antenna, my 1/2 watt 2 meter fox transmitter with 19" whip was detected (one LED) 140 feet away. All 10 LEDs were on at 45 feet. On the other hand, a very low power transmitter (49 MHz cordless phone handset) did not light any LEDs on the R20 until it was 13 inches away.

With a four-element 2 meter quad connected to the bare R20 circuit board, detection range of typical 1 watt foxes will be several hundred feet. Of

course, as in the car commercials, your results may differ, depending on transmitter power, antenna, multipath, and effects of other RF sources in the area.

As Figure 2 shows, the R20 is slightly less sensitive than the CCB on the 2 meter and 125 cm bands, but it is more sensitive elsewhere in the spectrum, particularly at UHF and above. The R20 showed the normal leakage from my microwave oven (2400 MHz) at half-scale indication, compared to quarter-scale on the CCB.

Coupling capacitors in the CCB and R20 are selected to roll off response below 4 MHz. I could not hear audio of a 50,000 watt AM station with it until I

was a block away. The display read only half-scale when I was 100 feet from the tower! So don't try to use the R20 to hunt signals on 160 through 40 meters or in the AM broadcast band. This rolloff was designed in deliberately. Without it, sniffed-out VHF signals would be QRM'd by local AM broadcasters and covered by 60 Hz hum from nearby power wiring.

Supply current drain is 25 milliamperes with no LEDs on and 84 mA with all 10 lit. There are no indicators for power on or low battery. Specified life of the standard 9-volt battery is three hours minimum, but this is very conservative. I measured full sensitivity operation down to 6.1 volts, thanks

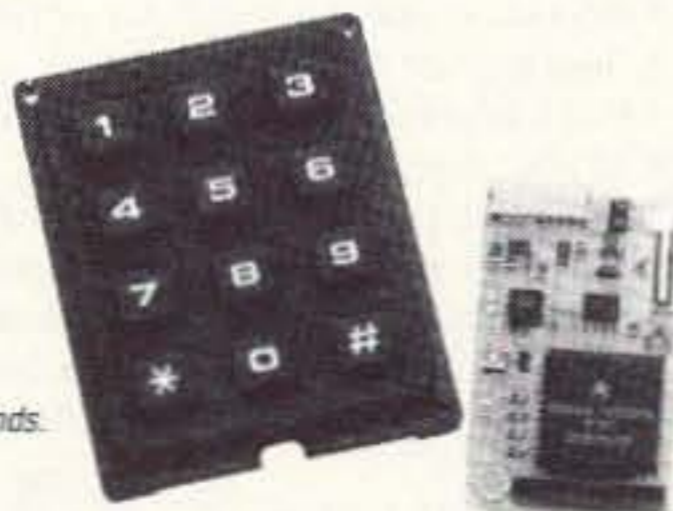
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to a low-dropout LM2931 regulator inside. Besides, you can sniff out the T in less than three hours, right?

The supplied whip antenna conveniently telescopes down to fit entirely in the R20 case, but it is only 12 inches long when extended. No external antenna jack or RF ground return connection is provided. That's fine for quick checks of your 2 meter handheld or for listening to the local airport tower as you sit in the terminal, but for bearings with your directional antenna, you will need to make some modifications.

For serious T-hunt work, consider removing the 2.6" x 2.1" circuit board from its plastic case and mounting it into a small metal box with a BNC or UHF connector for your RDF antenna. I suggest you choose a box big enough for two batteries and a selector switch. With a spare, you can quickly recover from "battery death" in the middle of sniffing out the hidden T.

While the R20 does a good job of receiving nearby AM-mode aircraft band transmissions, KD4HGT of Optoelectronics warns against using it on your next flight. Even though it has no oscillators to interfere with communications or navigation systems, he says it is illegal to operate it on a commercial aircraft.

FM signals cannot be demodulated by the R20 under normal circumstances, but they "quiet" the background hiss. This phenomenon can help identify FM emitters. Occasionally,

the audio of an FM transmitter is readable if multipath (signal reflections from buildings, walls, etc.) causes two or more signal components to arrive at the R20 antenna at approximately equal levels but with time/phase differences.

If demodulating near-field FM signals of unknown frequency is important to you, consider upgrading to the larger and more expensive (\$359) Optoelectronics R10 FM Communications Interceptor.

The R20 has no volume control. I found that earphone volume on 100 percent modulated VHF AM signals is comfortable, but might be inadequate in places with nearby loud noise. In any case, you should have no problem figuring out whether the AM signal you're tracking is CB, aircraft, ELT, amateur, or something else.

Unlike the CCB, the R20 is not sold in kit form. The suggested retail price for an assembled/tested unit is \$119. It is available from the manufacturer and some ham radio dealers. For more information, write Optoelectronics, 5821 North East 14th Avenue, Fort Lauderdale FL 33334 or phone (305) 771-2050.

#### Computerized Display Update

A lot of hams are also digital enthusiasts, so it's no surprise that interest remains high in computerized systems for mobile RDF bearing taking and processing. Jerry Boyd WB8WFK recently

reported his progress in upgrading his setup, which was described in "Hom-ing In" for January and February 1993.

Jerry uses a manually-rotated 2 meter beam with the mast angle (azimuth) and signal strength sensed, digitized, and plotted by a laptop computer. Recently, he replaced the analog potentiometer azimuth sensor with a Hewlett-Packard 10-bit shaft encoder. "The encoder works great, much better than the analog pot," Jerry told me. "I got a James Millen gearbox, so I have the analog pot and the encoder on the same shaft."

Much of Jerry's effort has been toward speeding up the system. As described last year, it took data for 25 seconds, then plotted 256 bearing points and calculated azimuth of the best bearing. "The original 10-per-second sample rate was not fast enough," WB8WFK says. "The data between points was real ragged. Now I have so many points that you can see the shape. Even on a noisy signal that barely raises the S-meter, you can actually see the shape of the lobe."

WB8WFK's new laptop computer has a 386 CPU running 25 MHz with a VGA liquid crystal display. This allows him to eliminate the external Micromint Z8 board. Azimuth and signal strength data from the analog-to-digital converter unit now goes directly into the computer through the parallel port at much higher speed.

Jerry's new plotting software is writ-

ten in C language. "I have two new trigger modes to start data taking. I can trigger on antenna rotation or signal strength. Usually, I wait for the carrier to come on, then start spinning the antenna. When it detects motion, it starts acquiring data at 200 times per second, then automatically plots.

"Also, I have an overplot mode, similar to a storage oscilloscope. If I start turning again, it takes data again without erasing the previous plot, so two plots are now visible. I can save data to disk, but only data from the most recent sweep. The software also provides correction for vehicle heading. When you enter in the reading from my car compass, the software corrects the display to be relative to true north."

Jerry is a regular participant in Albuquerque T-hunts, which begin at 9 a.m. on the first and third Saturdays of every month. The starting point is on the University of New Mexico campus and the frequency is 146.565 MHz simplex.

WB8WFK would like to compare notes with others who are experimenting with computerized bearing displays for rotating VHF yagis and quads. You can write to him at his *Callbook* address. Of course, I'm eager to hear of your new RDF ideas and devices, too. Write to the address at the top of this column or send e-mail to JoeMoell@cup.portal.com (Internet) or 75236,2165 (CompuServe). My packet address is K0OV@WB6YMH.#SO-CA.CA.U.S.A.NOAM. 73

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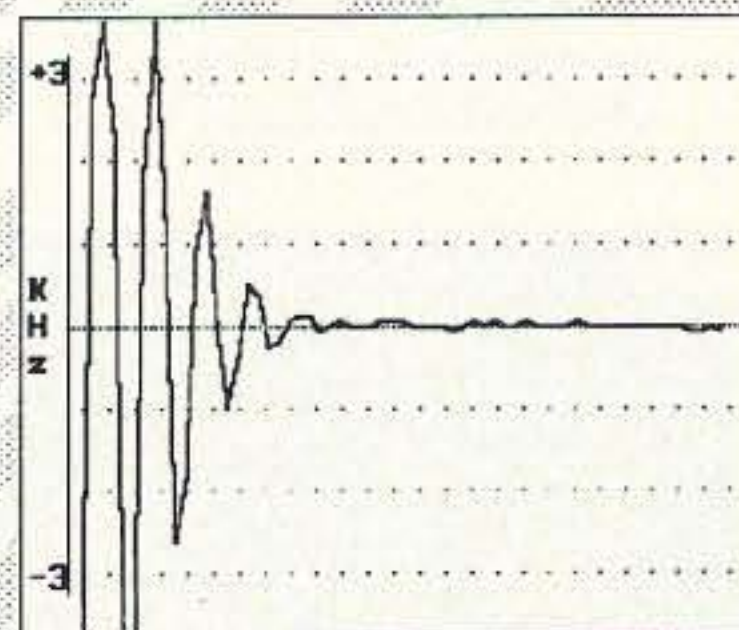
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## Payload Packaging

Twice a year my school district in Staten Island, New York, has a professional growth day for the teachers. Various workshops are offered for teachers to get enrichment and to expand their expertise and teaching techniques. In November I was fortunate enough to get into one of the NASA workshops, along with 200 other teachers in the district. The NASA workshops were so popular that they had to run five of them simultaneously.

The seminar ran all day, and each NASA instructor covered a great deal of information. They each emphasized their own area of specialization, such as chemistry, physics, or aviation. You should have seen grown-up people who happen to be teachers making paper airplanes and flying them around the room. At most NASA educational workshops tons of material is distributed. At the "paper airplane" session I got a wonderful activity book called *Sky School*. There are at least five lessons in this book that would be an excellent addition to the curriculum of a ham radio program.

When I do a unit on space travel and communications with my sixth, seventh and eighth grade ham radio classes, I like to include something new every term. There is a plethora of

charts, maps, photos, books, and pamphlets available from the NASA Teacher Resource Centers across the country. Some of the materials are free; most of the others are inexpensive. I've included a very useful address for teachers at the end of this column.

Any instructor who uses SAREX lesson plans and activities in the classroom will find the "Payload Packaging" lesson to be a terrific experience to add to your repertoire. The topic areas are: a. Protection from vibration, acceleration and deceleration; and b. Shock absorption.

The materials required per student are one raw egg and one container with the following restrictions: no larger than 6" x 6" x 6"; must weigh at least one pound (total weight with egg). Other materials include assorted packing materials, cups for the eggs, a trash can to dispose of the packaging, large trash bags, triple beam balance (especially if density calculations are used), a ruler for volume measurements, a stopwatch for drop times, and newspapers.

### The Lesson

Pivotal question: Can an egg be packaged in a container so that it remains unharmed after being dropped from a height of at least 30 feet?

Background Information: Although shock absorption is an important part of aeronautical engineering, this activity emphasizes creativity in design. A background discussion should solicit

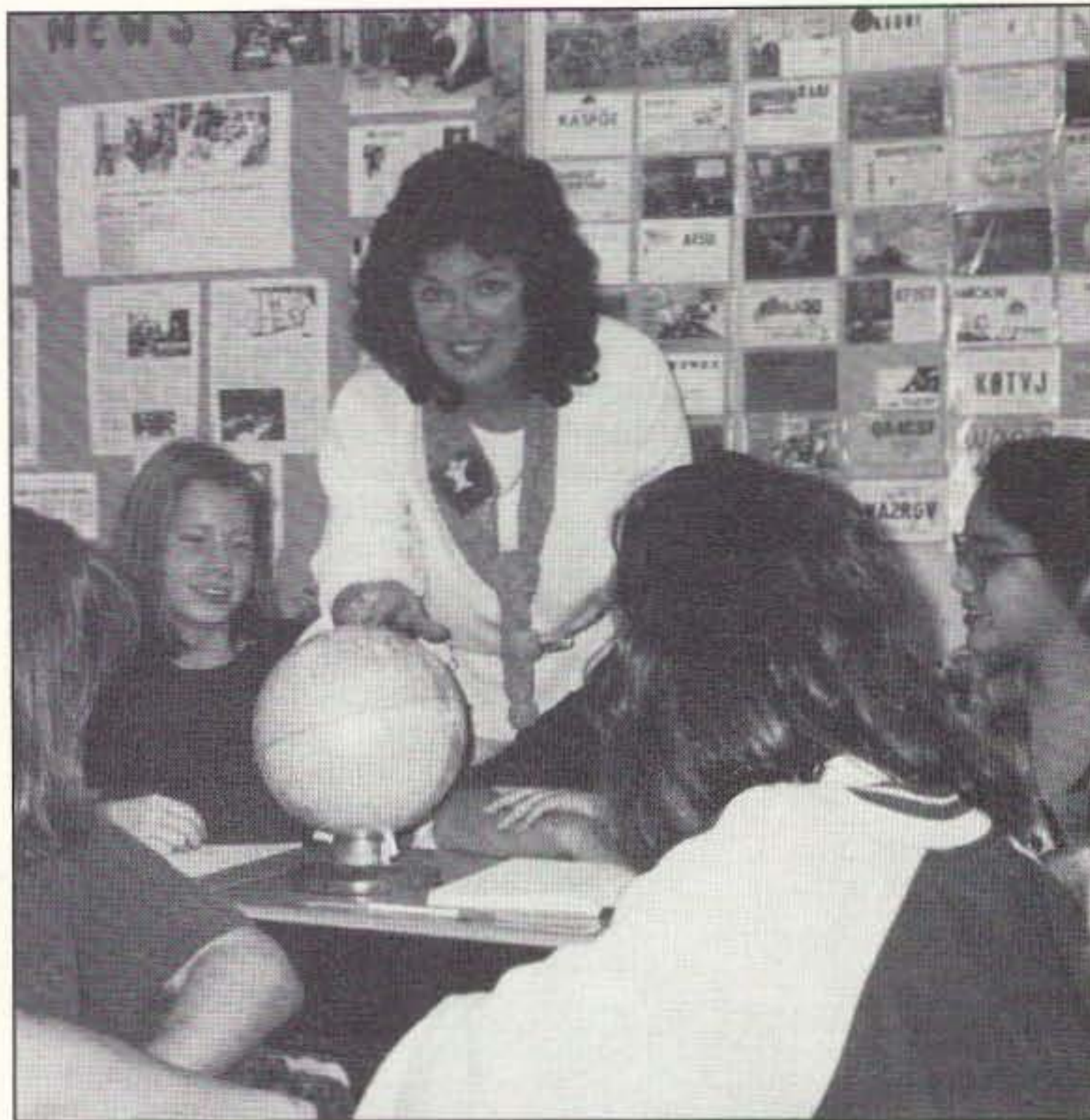


Photo A. The NASA enrichment lessons expose youngsters to career opportunities and introduce them to new interest areas for hobbies.

the many commonplace uses of cushioning. Examples might include the evolution of tires, padded rails on school buses, rides in amusement parks, baby car seat requirements, and food packaging.

Suggestions: Prepare the class for this activity at least one day ahead of time. Suggest ideas for the variety of packaging materials students can try for packaging the egg. (You might want to add the restriction that no money be spent on this assignment). Provide

newspapers to cover tables for the egg-drop. Be prepared for a mess when some of the eggs break. Students should package the eggs at home. Prepare a "cut away" package for display.

### Procedure

1. Assign the students to prepare a container with the above mentioned restrictions, in which they have packaged a raw egg. Encourage students to package their eggs with materials they believe will prevent it from breaking after being dropped from a minimum height of 30 feet.

2. Have students bring in their boxes. Provide arrangements to verify size and weight. Provide labels for students to write their name on for the boxes.

3. Have students complete handout, "Payload Package Drop."

4. Go around the room and have each child describe what materials he or she used to package the egg. List the items on the board. Have the students predict which eggs will make it in five categories: a. Survival in good health; b. Living . . . but with cracked skull; c. Unconscious, with brain damage; d. Total scramble; e. Missing in action.

5. Drop the egg packages, one at a time, from a height of at least 30 feet.

6. Bring the "dropped" packages back into the classroom, where students open them.

7. After everyone has checked their eggs, count up the number of eggs in each of the categories and, as a class, record the results.

8. Discuss results of egg-drop activity. Assess and rank-order the quality of materials for shock absorbency. Highlight possible modifications in design for packages with eggs that did



Photo B. Ham radio classes love to do enrichment activities from the NASA educational programs. In this photo, students brainstorm for the "Payload Packaging" lesson.

not survive. Interpret the usefulness of shock absorbercy to areas other than flight.

Review of what the students will do: They will discuss payload packaging. Students will design a "blueprint" for the design of a package for the raw

Patterson Biggs, Aerospace Education Services Project, NASA Headquarters, Code XEO Washington, D.C. 20546; and Debi Dyer at Science Instructional Specialist, Virginia Beach City Public Schools, Virginia Beach, VA 23456.

**"Any instructor who uses SAREX lesson plans and activities in the classroom will find the 'Payload Packaging' lesson to be a terrific experience to add to your repertoire."**

egg. They will construct a container to protect a raw egg. They will record and discuss data and results.

**Follow-Up**

Here are some good suggestions for follow-up activities:

1. Provide awards in various categories—best decorated package, most colorful package, most unique package, most likely to scramble, survival of the fittest, and messiest.
2. Have the students drop the boxes with a homemade parachute, balloon, or other air-drag device.
3. Package multiple eggs.
4. Investigate existing designs in running shoes.

**Information Sources**

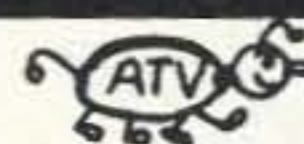
The Sky School Instructors are

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For more information about how to get your school involved with the SAREX (Shuttle Amateur Radio Experiment), write to: Educational Activities Department, ARRL, 225 Main Street, Newington CT 06111. **73**

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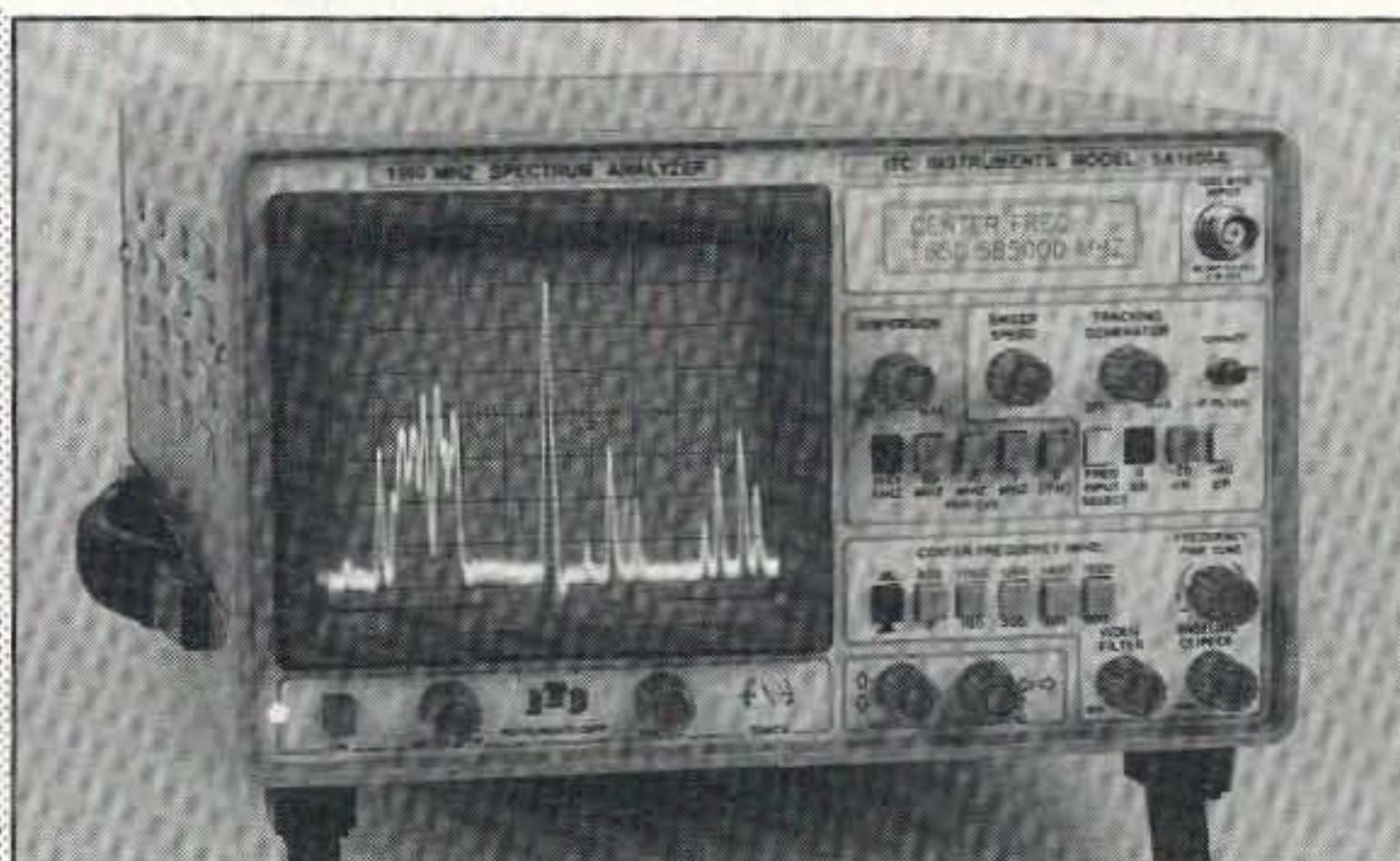
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### The Argosy, Continued

The original Argosy, the model 525, was introduced in the summer of 1981. The basic rig went for \$549. The 525 was discontinued in the summer of 1983 to coincide with the arrival of the Argosy II, the model 525D. The base price for this rig was \$599. The Argosy II was discontinued early in 1988 at a price of \$745. Many thanks for Tom Salivetti of Ten-Tec for digging up those details from the Ten-Tec archives.

The Argosy and the Argosy II have been in demand ever since they were introduced back in 1981. So, it's not surprising to see hams making modifications to these rigs.

In an issue of (the now defunct) *Ham Radio* magazine several years back, an article appeared on modifying the Argosy. For the life of me, I cannot locate the issue or identify the author of the work. I do know it was quite extensive and included a digital readout for the Argosy I. In fact, I've been told, some of the receiver modifications were included in the Argosy

II by Ten-Tec. If my memory serves me, the modifications were rather heavy-duty. They were definitely not beginner mods you would make in an afternoon soldering session. If you know the name and call of the author, and the month and year of the article, how about dropping me a line? I'd like to tell others about this piece.

### RF Gain Control Mod

One of the most common complaints about the Argosy is the lack of an RF gain control. The modification I'm describing requires you to do some soldering directly to the PC board of the Argosy. If you don't feel comfortable doing this, then don't! The modification is simple, requiring only a potentiometer, a diode, a resistor and a soldering iron. This RF gain control modification is by Ten-Tec from their QTC bulletin TN2-525.

You'll need a dual concentric 10k potentiometer. Remove the audio gain potentiometer. Connect the original audio control wires to the center potentiometer. Refer to the schematic in Figure 1. Connect the rear section of the potentiometer as shown. With that done, you now have a variable RF gain control and audio gain on the same potentiometer. But, you'll

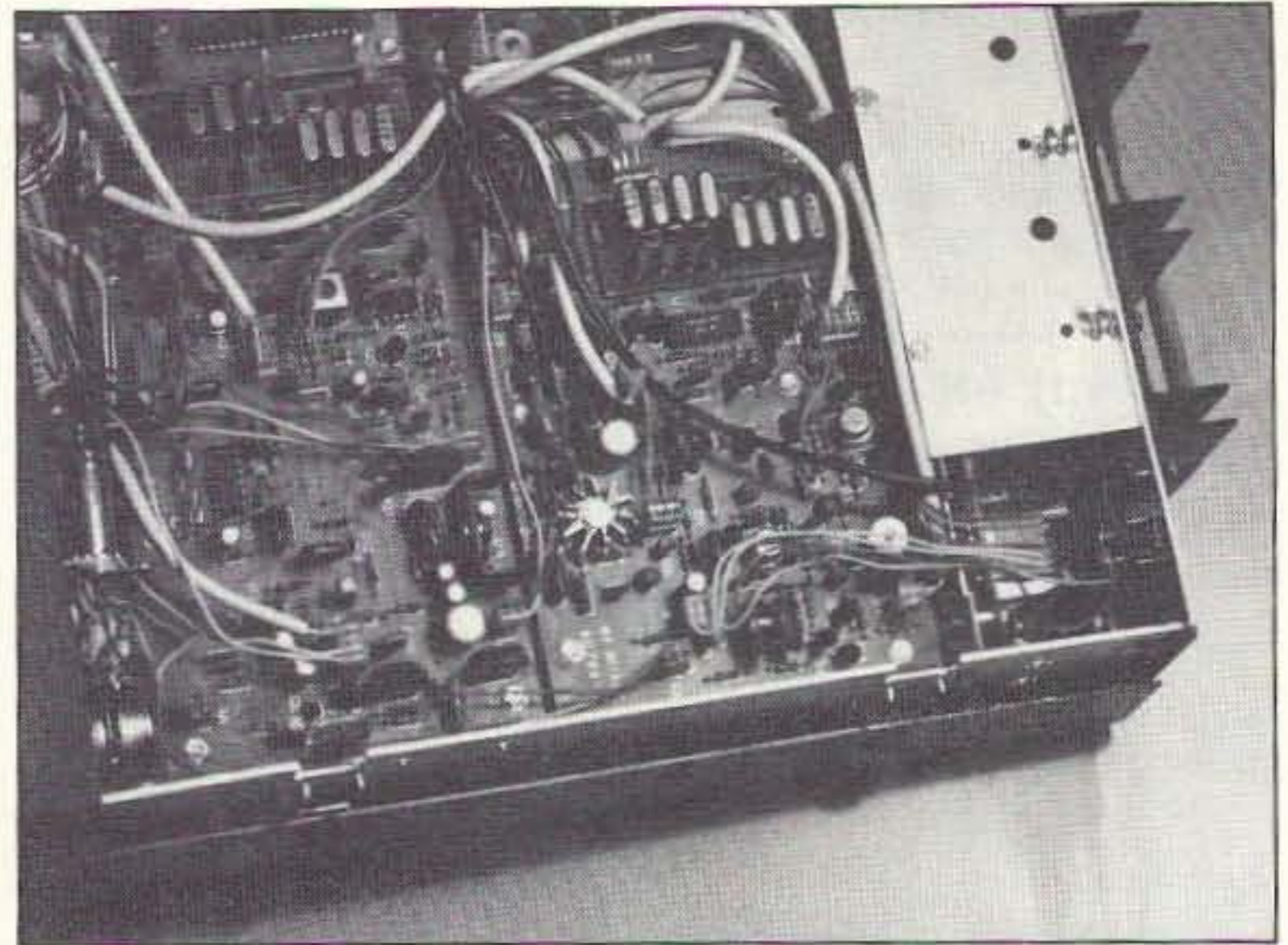


Photo A. The two crystal filters are clearly shown in the Argosy II. The 100 watt input PA is hidden under the shield.

end up losing the power switch. You must then either turn off the power supply to the Argosy or use the magnetic circuit breaker if you're working from a 12 volt battery supply. I don't know if this modification will work with the Argosy II—I haven't tried it.

To eliminate the dual pot for the above modification, wire in the noise blanker so it's on all the time. This frees up the noise blanker switch. You can use the noise blanker switch to turn on the above circuit. A small 10k trimmer would replace the panel-mounted potentiometer. You end up

with a fixed attenuation pad of say 10 to 20 dB. A hunk of perf board would hold the parts inside the rig.

### Dial Light Mod

Another popular modification centers on the dial light for the meter. In the Argosy II, you can turn off the LED display, but the meter light still remains on. The modification is simple: You just rewire the meter light so it is controlled by the same switch as the display. So, when you turn off the display, the meter light goes out, too. This really saves the juice when working from a battery supply.

### More Goodies

Since you can have your choice of crystal filters with either model, some of you may not know that the basic four-pole 2.5 kHz filter may be swapped out for a narrower filter, an eight-pole with a 2.4 kHz bandpass. It's a Model 220 filter. Most of the crystal filters are still available from Ten-Tec. The same goes for instruction manuals and most of the parts making up the Argosy series.

Another little-known fact about the Argosy is its ability to drive an ampli-

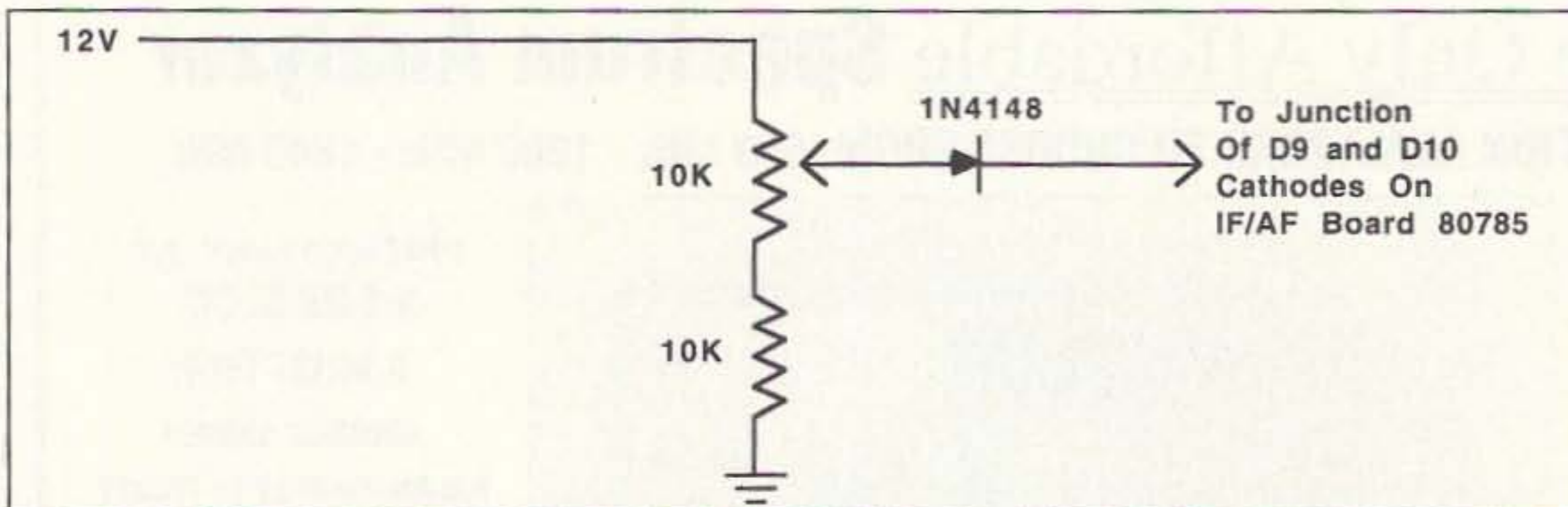


Figure 1. Schematic for the RF gain control modification to the Argosy.

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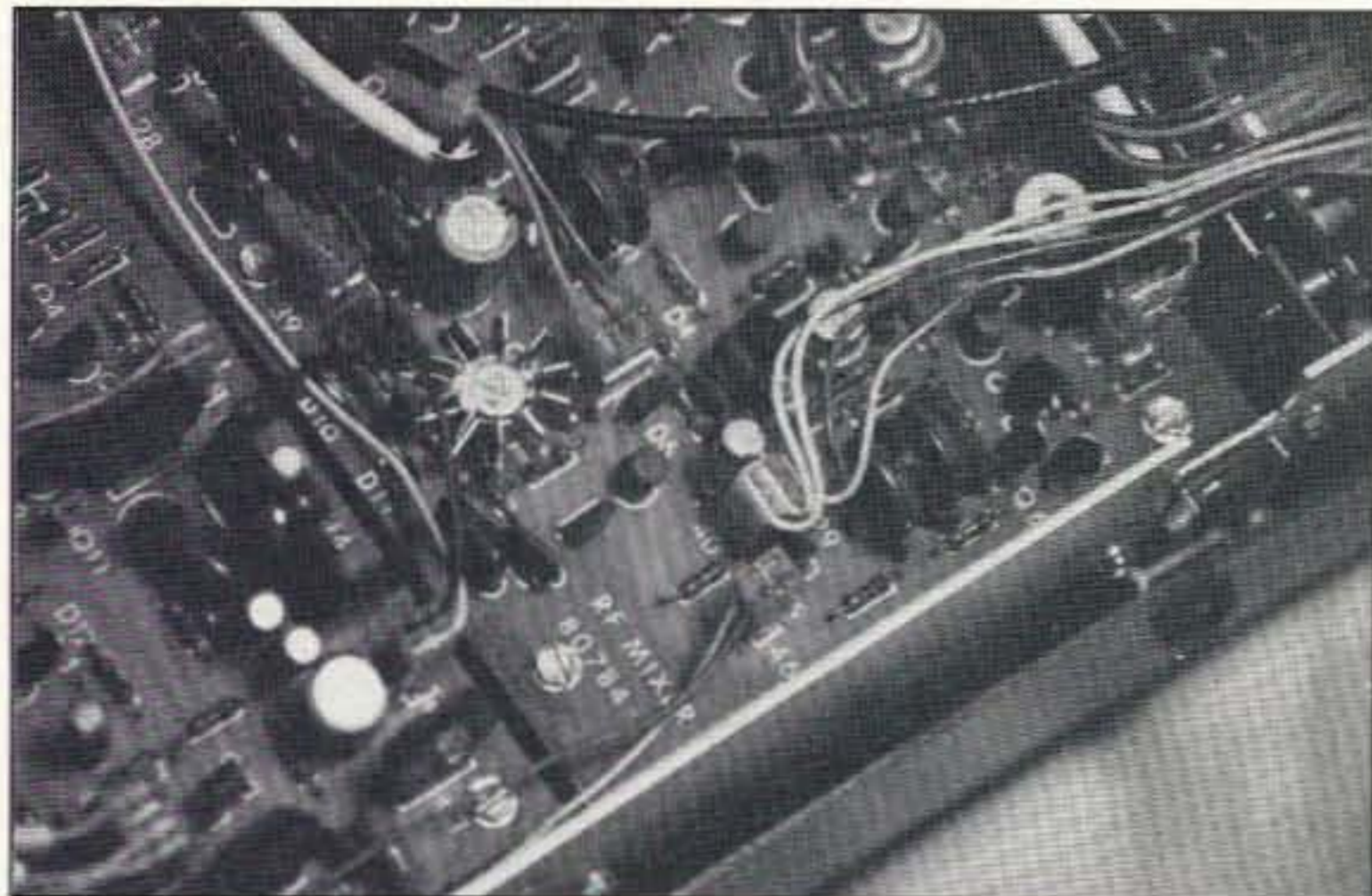


Photo B. These two trimmer pots set the ALC for high power and low power.

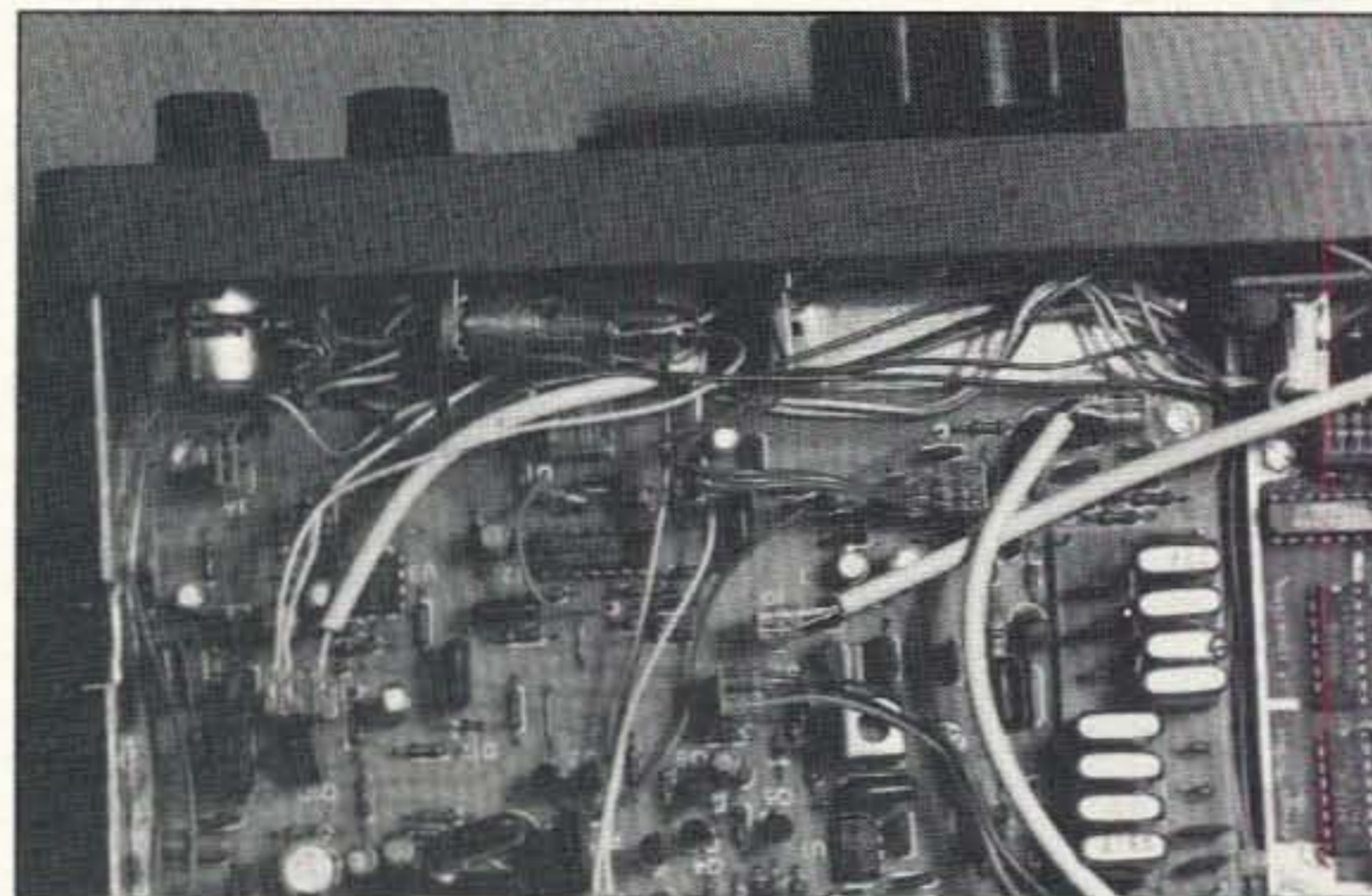


Photo C. The meter lamp can be easily turned off with the LED display.

fier. Granted, the 50 watts of RF output won't drive your Heathkit SB200 full blast, but you can make it work. Randy KD8JN drives his Heath amplifier with an Argonaut 509. He won't say how much he gets out, though.

Ten-Tec made a small PC board which would fit inside either Argosy. Their part number for this module is 80853. This module would provide a delay break-in to control an external amplifier. It's a rare find. If you wanted to, you could easily make your own control board to do the same function as the 80853 board.

There are two more easy-to-do modifications for the Argosy II. They involve the setting of the ALC trimmers. There are two trimmers on the

80784-D board. One sets the high limit for the high power position while the other will control the low power position. If you're a real QRP nut, then 5 watts output is way too much

my power supply is my battery bank, its nominal voltage is 12.5 volts, so I have the ALC set for high power at 40 watts RF output. Higher output power is possible, but the ALC LED

with the small heat sink. It seems if you switch from high to low power while transmitting, you'll pop Q3.

If your Model 525 will not read forward RF power, check diodes D6, D7, and D8. Also check for continuity on L15. It has a tendency to become open. All these parts are located on the SW/low-pass filter board #80805.

Even though they are no longer made, both the Argosy I and Argosy II can still be heard on the ham bands. It's really rare not to hear one during a QRP contest. At Dayton, it's very common to see a sign on someone's back reading, *Want to buy Argosy I or II. Like I said, You'll have to pry my cold dead fingers off of my Argosy II.*

**"Like I said, You'll have to pry my cold dead fingers off of my Argosy II."**

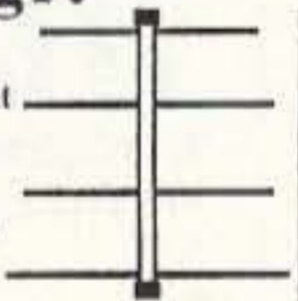
power. By adjusting the ALC trimmer, you can have the power level you want and still have full ALC control. This is something the original Argosy did not provide. I have the ALC set for my QRP position at 2 watts. Since

won't light when operating on the battery supply.

If you have a dead transmitter on an Argosy I, I'll put my money on a blown driver transistor on the RF/mixer board #80784. It's Q3, the one

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### Getting Started with TCP/IP, Part 5: AUTOEXEC.NOS

[This column is Part 5 in a series on using amateur TCP/IP. In this series we are using KA9Q NOS in the form of JNOS (WG7J) version 1.07b or 1.08c. The software is available in the "Packet & Computers" area of the 73 BBS; (603) 924-9343, 300-2400 baud, 8 data bits, no parity, one stop bit.]

The primary configuration file for NOS is AUTOEXEC.NOS. This file functions much like DOS's AUTOEXEC.BAT. Entries in it are executed as if typed in at the JNOS command prompt. JNOS also offers a facility to include other files in AUTOEXEC.NOS by reference.

Some entries in AUTOEXEC.NOS are position-dependent—that is, certain statements must precede them to get the expected result. For the most part, though, the order in which statements appear in the file is arbitrary. In order to easily learn about

the AUTOEXEC.NOS file, we'll divide it into logical sections. These sections are not enforced by JNOS—they are a convenience for us.

Let's take a look at the conventions used in the AUTOEXEC.NOS file. Below is a typical entry:

```
isat      yes      # 286/386 clock
```

"isat" is the parameter that we are setting (this tells JNOS that you are using a 286 or better clock). Separated by an arbitrary white space—spaces or tabs—is, in this case, a binary switch. It is called "binary" because it is either on or off. Most JNOS commands that use binary switches accept a variety of values: y, yes, true, on, 1, set, enable (to turn a feature on); and n, no, false, off, 0, clear, disable (to turn one off). The "#" precedes a comment. Whatever follows a # on the line will be ignored by JNOS as it processes the file.

#### Creating a Working AUTOEXEC.NOS

Let's start our look at the entries that are necessary to produce a working JNOS station. These are the en-

tries that create a basic configuration which will let you get your JNOS station on the air.

#### DOMAIN

The domain command sets or displays parameters related to mapping between names (e.g.: n1ewo.ampr.org) to numerical (e.g.: 44.48.70.21) addresses, and provides a way to add DNSs (Domain Name Servers) to your configuration.

This translation service is very important. To understand why, let's take a look at the two types of addressing. Numerical addressing is the "native" way that TCP/IP determines how to find a device on a network. Here's how it works: Each numerical Internet address consists of four bytes. Each byte—eight bits of information—can have one of 256 values. When an Internet address is written it is usually done by writing the value of each byte (in decimal notation—that is base 10 or "normal") separated by a dot (.). Internet addresses come in three classes—A, B, and C. Class A addressing uses just the first byte to distinguish the network; the last three bytes are for the "host" or device version. This sort of addressing is used when there are few networks and lots of devices connected. Class B uses the first two bytes for the network, which balances the number of available network and device address. Class C (you guessed

it!) uses the first three bytes for the network address, the last byte for device addresses.

The most common addressing class used in the amateur TCP/IP world is C. Amateur addresses always start with 44. This is the address for the domain AMPR.ORG; the name ampr.org maps to the addresses that lie in the 44.xx.xx.xx address space. All amateur addresses assigned by IP coordinators are sent to a host at the University of California at San Diego called mirrorshades.ucsd.edu. This host acts as a router. This means that any time there is traffic anywhere on the Internet that starts with 44, it is sent to mirrorshades, which looks at the address and sends it on its way to the correct gateway.

The second byte in an amateur Internet address points to a particular region of the world. For example, 44.48.xx.xx is somewhere in Indiana, because of the 48. The 48, in this case, is the Indiana subnet. How the next two bytes are used is up to the local IP coordination mechanism. Here in Indiana, we have regional subnets (yes, you can have subnets in subnets). I am located in subnet 70. This makes my first three bytes: 44.48.70; add 21 to this and you have my complete address: 44.48.70.21. 21 is the host (I also call this "device," since it could be any sort of networked hardware) portion of the address. There

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are up to 255 devices on the 70 subnet. Why not 256? Because, by convention, hosts are never assigned 0 addresses; these are reserved for networks. The address 44.0.0.0, for example, addresses the traffic to the *ampr network*.

OK, so now you have some idea of what the numerical address is and how to read it. What about the name stuff? Obviously the numerical address is not particularly user friendly. It is also absolute—that is, always points to the same machine or device. Names get around both of these things. First, it is a lot easier to remember *n1ewo.ampr.org* than *44.48.70.21*. The first part is my call; the second is the name of the amateur Internet subnet. This formula works for most amateurs on Internet—though some use SSIDs (Secondary Station Identifiers, e.g.: *N1EWO-1*) or other names.

The other advantage of names is that where they map can change arbitrarily. For example, a while ago, in this column, I reported on K9IU and its Internet—>amprnet gateway. In the piece I specified K9IU's numeric (Internet) address. Because of this, when the sysops of K9IU had to make changes to their hardware configuration, which moved the gateway to a new Internet address, they had to do a bunch of fancy footwork. Had I instead just told you about K9IU.AMPR.ORG,

it would have been a simple matter for the sysops to tell mirrorshades that this name now mapped to the new address.

So this domain stuff is pretty important. Most of your domain name services will come from looking at a local file called *DOMAIN.TXT*—this file contains names and their associated Internet addresses. To do this name-to-address mapping, JNOS looks in the *DOMAIN.TXT* file and finds the entry that matches the name it is working with. This means opening the file, and parsing (reading and interpreting) it—a very (time-) costly operation. A TCP/IP conversation involves lots of packets, each with a header that might require this translation. Because of this, setting up the domain services can have an effect on performance.

The first setting we'll look at is the *cache size*. A cache is a space in memory which is set aside to store some particular sort of memory object—in this case, a name—>address mapping. When JNOS needs to make a translation it will first look in the cache (much faster than opening and reading a file) and use what it finds there. If you have recently communicated with a station this information may reside in the cache and speed things up. The cache size is set with the command:

`domain cache size <n>`

where *domain* is the command, *cache size* is the subcommand, and *<n>* is the number of entries to be cached. The limit is based on available memory and the default is 5. You should set this parameter to a number large enough so that you usually don't have to open your *DOMAIN.TXT* file. You can tell if this is happening by watching for disk activity when your station tries to *resolve* a name.

The next domain subcommand of interest is "translate." This subcommand determines if JNOS will try to convert numerical addresses to names whenever it displays them (in trace mode, for example). This can be a real CPU hog, so unless you really need it, turning it off is a good idea. To do this, the entry should be:

`domain translate off`

The last domain subcommand for the *AUTOEXEC.NOS* needs some explanation. It involves the use of a Domain Name Server, or DNS. If you live within radio earshot of a real Internet gateway this may be of use to you. A DNS is a machine that has a comprehensive *DOMAIN.TXT* file. When you try to use a name that does not appear in your own *DOMAIN.TXT* file, JNOS will contact a DNS that you have specified. If the DNS has the name you are looking for, JNOS will add it to your *DOMAIN.TXT*. This is a great service if you can take advan-

tage of it. The command looks like this:

`domain addserver <host> <time out>`

where *domain* is the command, *addserver* is the subcommand, *<host>* is the host ID of the DNS, and *<timeout>* is an optional timeout in seconds.

You can control whether your station updates the local *DOMAIN.TXT* based on the DNS server response with:

`domain update <boolean>`

where "domain" is the command, "update" is the subcommand, and "<boolean>" is on, off or one of the equivalents mentioned earlier.

Finally, you can turn your own station into a DNS using the command:

`domain dns on`

where "domain" is the command, "dns" is the subcommand, and "on" enables the DNS server built into JNOS—the default is off.

Next month we'll continue with *AUTOEXEC.NOS*, taking a look at interface configuration. (NOTE: A working JNOS *AUTOEXEC.NOS* file is available on the 73 BBS in the "Packet & Computers" file area. The file is named: *JNOSAUTO.TXT*.)

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## VHF and Above Operation

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The winter weather and all of its ill effects should keep you indoors awhile, leaving you more time for in-house construction projects. Continuing along with that theme, this month I would like to cover a few little gems to keep you and your soldering iron busy. Let's consider construction of preamplifiers for the low VHF range. This month I'll cover component selection and parts substitution, and how to modify circuits accordingly. The primary goal is to use components you have on hand. Consider a dual-gate MOSFET preamp for 30 MHz. See Figure 1 for the schematic details.

The amplifier shown in Figure 1 can work well over the frequency range of 10 to 50 MHz. The 40673 dual-gate MOSFET is capable of higher frequency operation; however, there are better devices today for those applications. If you want to build this circuit it will work; however, it is primarily used for component selection examples. With the schematic diagram (Figure 1) in mind, let's go shopping for parts. Don't

go and purchase everything brand-new—a lot of retailers would appreciate that, but rather see what components you have on hand that can fill the bill to hold down costs and keep the project in a "hobby" realm.

Use the design in Figure 1 as a guide. It need not be followed exactly; most component values can be varied about 10% without changing the circuit performance. You do not have to use the exact material specified for the resonant elements (tuned circuits). Changing these components can be very cost-effective if you can use something you have on hand.

Let's take a closer look at the resonant elements, the inductors and the capacitors that form this part of the circuit. The inductors used in this circuit are two variable 2.1 microhenry ( $\mu\text{H}$ ) coils and two 25  $\mu\text{H}$  inductors. What do we go shopping for in the coil department? Two or three RFCs whose value is 25  $\mu\text{H}$  and two 2.1  $\mu\text{H}$  inductors for the resonant elements. The 25  $\mu\text{H}$  RFC's role on the input is not very apparent. This RFC provides a ground return for both the input tuned circuit to the amplifier and a DC path for the detector diode to ground. See Figure 4. It also matches the diode's higher

impedance. (Here is my chance to slip in some microwave activity). This preamplifier is normally used in WBFM applications for a diode detector in a microwave cavity. For 10 GHz, this is a section of waveguide, and for lower frequencies it could be a tin can called a polaplexer. It's basically a tin can or waveguide whose size/opening is the right dimension for the frequency of use. For 10 GHz, a copper pipe 1" in diameter is about right. For 1296 MHz, a one-pound coffee can is perfect. The diode detector is placed 1/4 wavelength at frequency from the back of the can and at 90 degrees in reference to the diode orientation. There are several ways this same coupling can be done but this is the most inexpensive method. Such a detector diode has an impedance of about 200 to 400 ohms, and when coupled to a preamplifier it will deliver maximum when the amplifier input circuitry is matched to this same impedance range, hence the input circuitry.

The output inductor (RFC) is used to separate RF and DC. It drives up DC power from the output coax and powers the amplifier for operation in a remote location from the main station equipment. The other two coils comprise the tuned circuit and are shown as variable coils. They can be fixed if we wish to make the capacitor (15 pF) variable. The circuit will work well either way with variable coils or variable capacitors. This is one of the cost-effective choices to make by using your "junk box."

What form can the inductor take to make the circuit work? As an example, take a toroid that is capable of working at 30 MHz. Look at Table 1. Looking at toroid cores from Amidon Associates, a popular amateur parts supplier, we determine that a T-XX-6 or T-XX-12 core is suitable.

At this point the -6 (yellow core) is the most important ingredient. The table states that a -6 core is good for 10 to 90 MHz use. A red core -2 could be used, but the frequency stated is not suitable; it's good from 1 to 14 MHz max. Alternately, a -12 core (green and white) would work, but that's kind of overkill; put this idea in the "might use" category. A -6 (yellow) core would be an easier core to locate in the junk box as it is very popular, more so than a -12. In either case, let's use the -6 yellow core and proceed to wind a 2.1  $\mu\text{H}$  inductor.

The Amidon charts list the toroid cores by core size (the XX above) and type (-2 or -6 or -12, etc.). Amidon has published a numerical value called "AL" or ( $\mu\text{H}$  per 100 turns). With this "AL" value for a selected core size we can compute the exact number of turns for our 2.1  $\mu\text{H}$  inductor. Let's select a T-25-6 core. By the way, the "25" of the part identification number refers to the size of the outer diameter of the core, in this case 1/4". In comparison, a T-37-X would be a core with a 0.370" diameter. Now, looking at Table 1, the "AL" value for the T-25-6 core is 27. That means that for 100 turns on a T-

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25-6 core the inductance would be 27  $\mu\text{H}$ . (Note: We might not be able to get 100 turns on this size core, but this is a figure used for calculations only and not actual winding). To determine what 2.1  $\mu\text{H}$  would be, a little math is needed.

Table 1 shows inductance if you were able to wind 100 turns on various type cores. On some smaller cores it is impossible to wind 100 turns so this number is imaginary but it is used in calculating the required inductance from that "AL" number.

The formula to determine the turns required is as follows: turns = 100 times the square root of the required inductance. A required inductance of 2.1  $\mu\text{H}$  divided by an AL of 27 equals 0.07777777. The square root of

0.07777777 is 0.278886675, and that times 100 equals 27.888. So we need 28 turns of wire on our T25-6 core for an inductance of 2.1  $\mu\text{H}$ . For this application, a wire size of #28 to #30 gauge enameled wire would be used. Benefits from this selection are that the input and output toroidal coils would not couple between each other, minimizing a condition called talking or crosstalk. That's oscillation when the input of an amplifier finds the output.

Toroid cores maintain the magnetic field within the core structure and minimize external fields. You can verify resonance of your toroid and its capacitor combination by using an instrument called a grid-dip meter. Toroid cores are difficult to grid-dip without some external coupling added for test

purposes. To grid-dip a toroid tuned circuit, put a turn or two on the core and make an external two-turn coil with a short section of wire. Couple the dip meter to the external temporary coil and you will read the actual toroid resonant frequency directly on the grid-dip meter. Adjust accordingly to meet your parameters. Add or remove turns or vary capacitance values to suit your requirements. Trying to do this without the link coil for testing is very difficult. See Figure 3 for this method of grid-dipping a toroid core.

An alternate to the toroid coil would be a small 1/8" or so diameter slug-tuned coil form. This form could be taken from an old TV set IF amp circuit or similar circuitry from a junk PC board. Remove the coil form and any wind-

ings on the form. For a 1/8" coil form (slug-tuned), 12 to 14 turns of #24 wire have worked well for me. You can experiment with the wire gauge and parallel capacitor using the same old grid-dip meter for testing before placing the coil and required capacitor in the circuit. I am trying to remember—I believe that I used a 25 to 40 pF capacitor to resonate the circuit at 30 MHz. A factor in this case was that the coil form I used had a ground shield around the coil form and this affected the entire circuit. Also, using a selection from the junk box can lead to some uncertainty on what you have form-wise, but verification with the grid-dip meter will remove all doubt.

Remember to measure everything so it will properly fit in the circuit. Also,

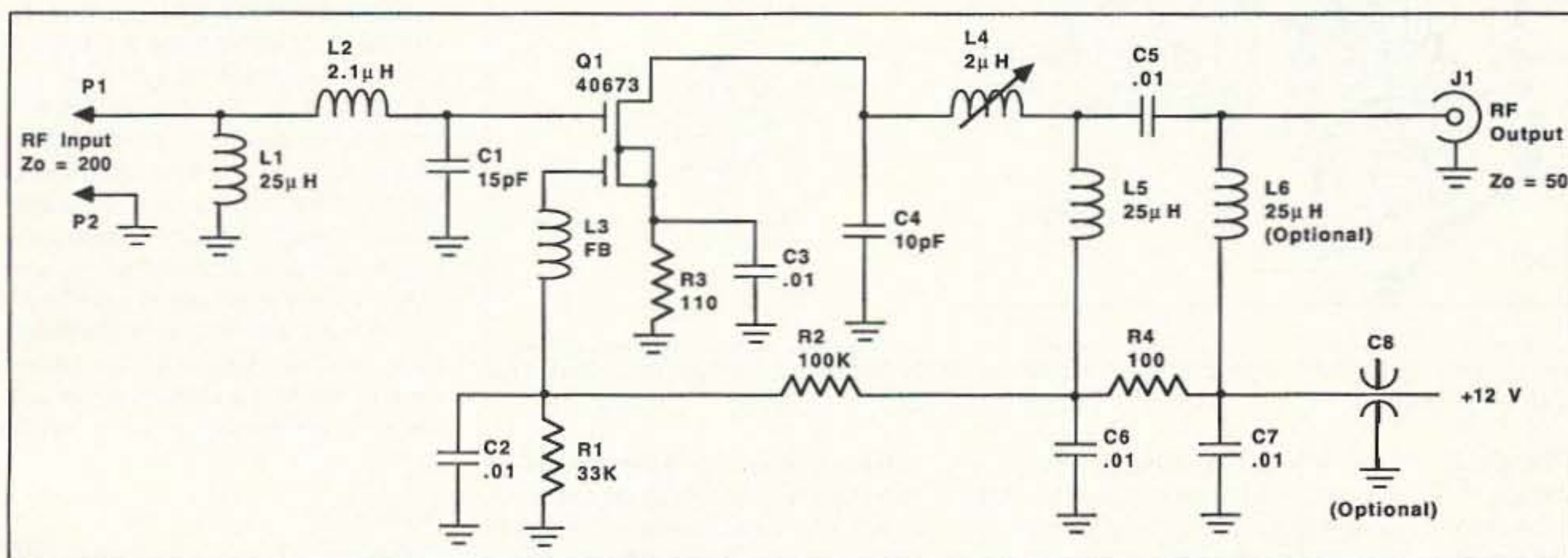


Figure 1. 30 MHz IF preamplifier schematic diagram.

placing shielding in close proximity to the coil form can detune the circuit; keep this in mind when placing shielding. If you do not use a shield cover (can), there could be substantial coupling between input and output and other shielding techniques need to be employed. Give different methods a try as not much is at risk here. The benefit from this construction is cost because you are more likely to find junk coil forms than toroids. Check out stability and add

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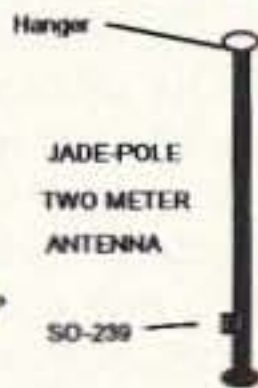
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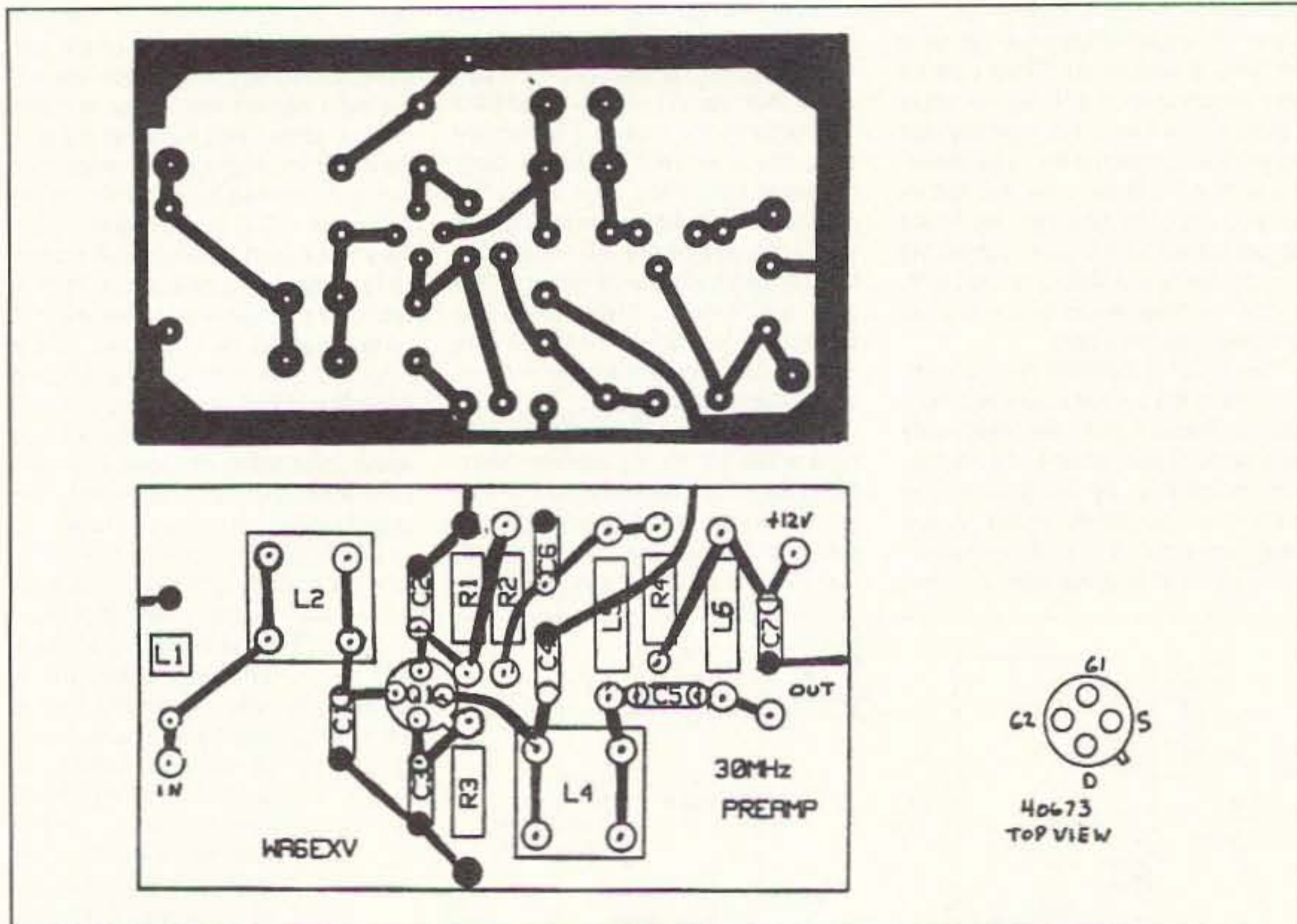


Figure 2. Drilled and etched PC boards for the 30 MHz IF preamp are available for \$4 plus \$1.50 S&H per order from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

shielding if needed to make the circuit an amplifier instead of an oscillator.

Another consideration for the resonant circuit is to put a capacitor of 60% or so of total value in the circuit and use a small-value variable to make further adjustments. This can be a real benefit towards experimentation. I am not going to get into other considerations such as device substitution for the 40673 dual-gate MOSFET.

The tuned circuits that are used in the input and output circuit can take many different forms and the results will be nearly the same. Some experience can be beneficial but you aren't dealing with a high dollar amount so you can experiment and learn a lot through what I call the "Edison Effect." That's the procedure used by the renowned inventor Thomas Edison who, through many failures, created devices of excellence.

What I mean is that you should feel free to use a substitution component in different circuits and see what the results are. They might not all work well but I assure you that with a few tries success will be yours. If the design used fixed capacitors and toroid-wound inductors to a specific inductance, be assured that the creator of this circuit used an impedance bridge,

or Amidon's coil chart, to determine the number of turns required. In either case, the exact component does not need to be used. Improvise something and try it out. What do you have to lose but time and a component you have on hand? Even if it does not work you have gained something from the school of hard knocks. Most of the time a substituted component will work and do it well.

One other thing to remember is that any coil you wind will vary from a stock circuit. Using Amidon's chart for the toroids they sell will result in a coil very near the inductance you desire. But, as with all things, it depends on how you distribute the wire turns on the core. Toroid cores wound for maximum efficiency have their wire spread or distributed over at least 80% of the core.

#### Slug-Tuned Coil Forms

You can replace toroid cores with small-diameter coil forms and fixed or adjustable capacitors and the results will be the same as long as coupling between the different coils is not great. Coils and capacitors can be preset before mounting to a circuit by checking with a grid-dip meter. This is actually an oscillator with an indicator and will

indicate resonance in tuned circuits—a very handy instrument on the work bench. I have had several of them over the years and the grid-dipper I now use is a James Millen solid-state unit. There are many different models and they all are quite good. I have even seen some in military surplus for under \$50.

Well, that's all I have to contribute on the selection of the components that seem to be most troublesome. The other components for capacitor values and resistor values need not be difficult and 10% or more tolerance components work out well. The only consideration here is in the capacitors that will carry RF; they should be selected from disc ceramic or mica types for good low-loss capabilities. If the frequency of the amplifier is increased to, say, over a GHz, then chip capacitors would be a better choice. Standard chip capacitors or surface-mount chip capacitors exhibit low inductance as they have no leads to hook them into a circuit. They are essentially leadless.

As you increase frequency again, from higher in the GHz range to over 3

GHz, special low-loss chip-type capacitors need to be used. These capacitors are still chip-type capacitors but are constructed out of special low-loss materials such as porcelain for a very high dielectric and low-loss characteristics at higher frequency microwave work. Each one of these levels in component parts represents a price increase for increased quality of the component. Disc capacitors are about a dime each, mica caps are 30 to 50 cents each, surface-mount capacitors are about 50 cents each, and high-grade low-loss RF types for microwave run from 50 cents to a dollar each. Just as frequency increases, so does the price and quality.

I hope I have given you some basic considerations for amplifier construction and when and what parts to try and select. I heartily suggest starting a junk box of components from scrap PC boards and old TVs and radios and whatever components you happen to locate at flea markets and swap meets. I have resisted the urge to pick up only what I want when I am shopping for components and if the price is right, I usually purchase far more than I will ever use. All these parts are stored away for "that day" and then I don't have to run off shopping and can use the time constructing on the work bench.

#### Mailbox

Raymond Elsner of Littleton, Colorado, writes, "Do you still have any of the 10 MHz frequency standards available?" (Model T-424, from 73, August 1992.) Well, I'm sorry to say, no. They were an item that I picked up and when I offered them I did not know that they would be so hot. I did pick up all that the locals did not and made them available. However, now they are gone. If I ever locate some more I will let everyone know.

Arthur W1PXL is looking for a noise bridge for 144 MHz. He is trying to construct one. I saw a unit that was good to  $\mu\text{HF}$  in the *RSGB Handbook* and recommend the circuit to Arthur. I have never used a noise bridge as I am blessed with an HP-250 impedance meter that I use for antenna measurements. It is another way to verify antenna impedance. The HP-250 was more sophisticated in that you could determine at exactly what frequency from 30 to 500 MHz the resistive and capacitive components of the impedance product were. You could

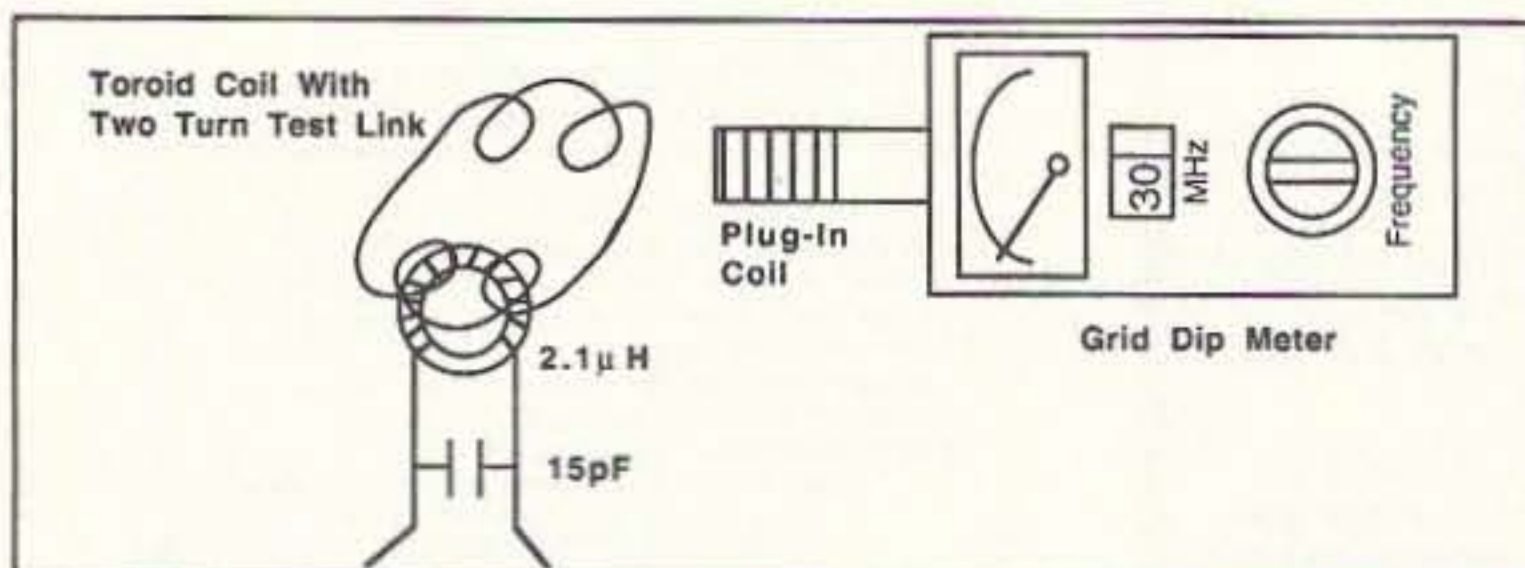


Figure 3. Method of grid-dipping toroid cores.

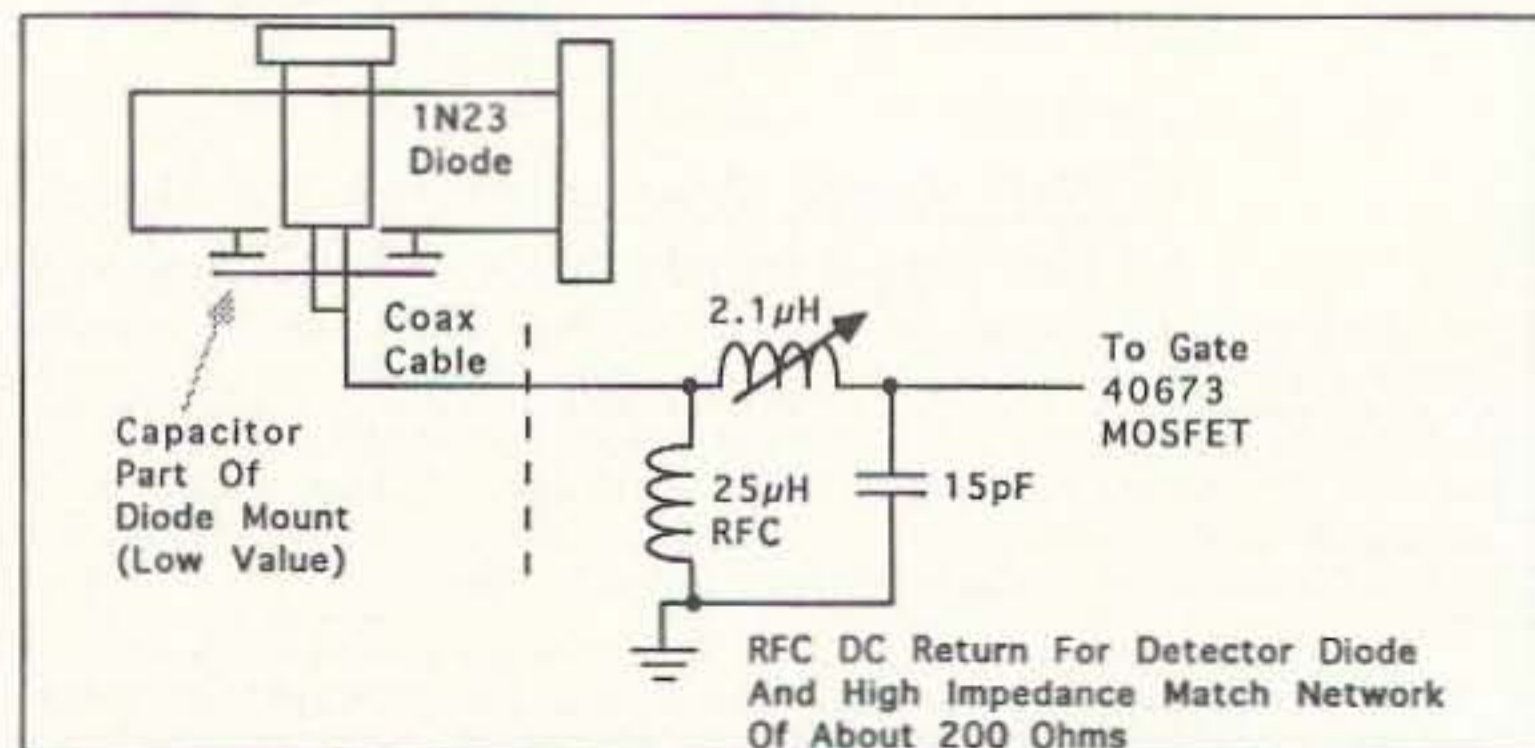


Figure 4. Microwave diode detectors matching circuit.

set an antenna to 50 ohms on the hair-line. The long and short of it is that I have done just as well with a simple SWR bridge that was home-constructed. I guess it demonstrates just how well you want to match something or how accurate you need to be. The HP-250 worked great but, as with all large devices, it went out the door, replaced by something smaller. If anyone can help further, contact Arthur at 6453 31st Avenue North, St. Petersburg, Florida 33710.

Thomas KD4UIX is interested in an all-mode 2 meter radio at affordable prices. Well, Thomas, that is not the way most new radios are going today. It seems that the cry for more bells and whistles is being met by most manufacturers today and there is not an inexpensive 2 meter multimode unit on

the market. The most inexpensive rigs I have seen are priced near \$700. Next month, in response to this letter, I plan to cover a conversion approach for a microwave IF using a low-band SSB transceiver for obviously SSB generation, covering modifications needed. Later I will detail a simple 2 meter converter to tie the package together. There are several possible rigs that can fill the bill for inexpensive SSB radios such as the Radio Shack 10 meter SSB rig or other similar units.

Well, that's it for this month. Next month I will expand on the conversion of SSB rigs for microwave SSB use. As always, I will be glad to answer questions about this and similar subjects. Please send an SASE for a prompt response. 73 Chuck WB6IGP. 73

**Table 1. AL Values ( $\mu\text{H}/100$  Turns)**

Core Type	MHz			
	RED	YEL	BLK	GRN & WH
T-200	120	105	-10	-12
T-130	110	96		
T-50	50	40	31	18
T-44	57	42	33	
T-37	42	30	25	15
T-25	34	27	19	13
T-16	22	19	13	8

(Core type and data courtesy of Amidon Associates, 12033 Ostego St., North Hollywood CA 91607.)



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PD-144N-2FM	144-148 Mhz	Preamp	YES	FM	4-5 WATTS = 60W	T/R	175	
PD-220N	222 Mhz	"	NO	FM	4-5 WATTS = 35W	T/R	119	
PD-440N	420-450 Mhz	"	NO	Linear	1/2 OR 4-5W = 18W	T/R	119	
PD-440N	420-450 Mhz	"	YES	"	1/2 OR 4-5W = 18W	T/R	143	
PD-440N-1	"	"	NO	"	1/2 OR 4-5W = 35W	T/R	155	
PD-440N-1	"	"	YES	"	1/2 OR 4-5W = 35W	T/R	179	
PD-440N-2	"	"	NO	"	1/2 OR 4-5W = 60W	T/R	285	
PD-440N-2R	"	"	NO	"	3-4W = 60W		199	
PD-440N-3	"	"	NO	"	3-4W = 60W	T/R	235	
PD-440NM	"	"	NO	"	1/2W = 6W		75	
PD-440NM	"	"	NO	"	1/2W = 6W	T/R	118	
PD-900N	902-928 Mhz	"	NO	FM	1/2W = 10W		65	
PD-900N	902-928 Mhz	"	NO	FM	1/2W = 10W	T/R	90	
PD-33LHP	902-928Mhz	"	NO	Linear	1W = 18W		265	
PD-33LHP	902-928 Mhz	"	NO	"	1W = 16W	T/R	299	
PD-33LP	"	"	NO	"	1W = 6.5W		119	
PD-33HP	"	"	NO	"	6W = 15W		125	
PD-33VLP-1	"	"	NO	Hybrid	5mw = 8W		123	
PD-33VLP	"	"	NO	Linear	1/2W = 1.5W		59	
PD-33 Doubler	70cm = 33 cm	"	"	"	1/2W = 1/2W		65	
PD-33 Doubler	70cm = 33 cm	"	"	"	1/2W = 1.0W		85	
PD-1200N	1.2Ghz	Preamp	NO	"	1W = 18W		149	
PD-1200N-2	1.2Ghz	"	NO	"	1W = 16W	T/R	205	
PD-1200N-3	1.2Ghz	"	YES	"	1W = 16W	T/R	299	
PD-1200N-1	1.2Ghz	"	NO	"	3W = 36W		285	

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### It Hertz So Good

As I write this, we are in the midst of the holiday season. For most people, visions of Thanksgiving turkeys and Christmas presents have filled the relaxed, idle moments. For a techie like me, though, those musings mingle with such delicacies as frequency counters and resonant circuits. This month, let's take a look at frequency-related issues.

### Count 'Em Up

What's the difference between frequency counters? What makes a good one or a bad one? The most obvious difference is in the maximum frequency the unit can count. Is faster necessarily better? In this case, pretty much. At least up to a point, anyway. If you never use anything higher than 2 meters, you probably don't need a 2 GHz counter, although it would pay to have one that goes to at least 250 MHz, just in case you need to count a local oscillator or something that goes above the band. But, there's more to a good counter than its frequency response.

### Exactly

How precise is the counter? And how accurate is it? Those are not the same. If it tells you that your frequency is 14.208758423 MHz, that's pretty darned precise! But, if it's off by 300 Hz, that ain't very accurate. Conversely, if it tells you that the frequency is 14.2 MHz when it's really 14.208, that's quite accurate but not very precise. Generally, today's instruments have more precision than accuracy, and it can be quite hard to look at all those lovely numbers and not believe them. I see lots of counters on the market which have eight or even 10 digits, but I doubt many of them have the basic accuracy to back those numbers up. (By the way, that's true of some 3-1/2 and 4-1/2 digit DMMs, too.) To be sure, take a look at the specs and you should find some statement of basic accuracy, such as +/- 10 ppm or +/- 300 Hz after warm-up. The Hz statement is pretty obvious, but what the heck is ppm? That refers to "parts per million." In the case of a +/- 10 ppm counter, it means that, if your measured frequency is 14 MHz, the counter could be off by as much as 140 Hz in either direction, because it can be off by 10 Hz for every million Hz you're counting. So, just multiply 10 (the number of ppm) times the number of megahertz and you know

what the true accuracy limits are. And even if the display shows digits right to the single Hz, those numbers may be lying if the accuracy isn't high enough. Of course, you have no way to tell for sure, and many instruments perform considerably better than their worst-case specs. The moral here, though, is not to go tweaking your radio down to the last Hz just because your counter says so, because it could be the counter that's wrong.

### Check, Please

Is there a way to know when your counter is right or wrong? Sometimes. Luckily, digital counters have no "slippage" of any kind between their reference oscillators and everything else. In other words, the counter's accuracy depends *entirely* on the reference's accuracy. If that reference happens to be at some multiple of 5 MHz, as many are, you can check it by listening to it with a shortwave receiver or HF rig. Just put the radio in AM mode and tune in WWV. Ideally, the counter's signal and WWV will zero-beat, meaning that your counter is dead on frequency. In the real world, though, it never happens. If the oscillator's adjustable, you can set it right on frequency, ensuring, for a while at least, that your counts will be correct. If it's not adjustable, try counting the beats. Once you know them, you can calculate the ppm of the counter. If you hear three beats per second, and you're tuned to 10 MHz, then you know your counter is good to 0.3 ppm, which is pretty good! The receiver's stability, luckily, doesn't play a part because, in AM

reception, the carrier (which is what you're beating against) is provided by the broadcast station (WWV), not the radio. By the way, this method works well for normal, home-type counters, but it isn't accurate enough for extremely accurate laboratory counters, because the atmospheric fading and random changes in the length of the signal path cause even WWV's carrier frequency to shift by tiny, random amounts. But we're talking pretty small shifts here.

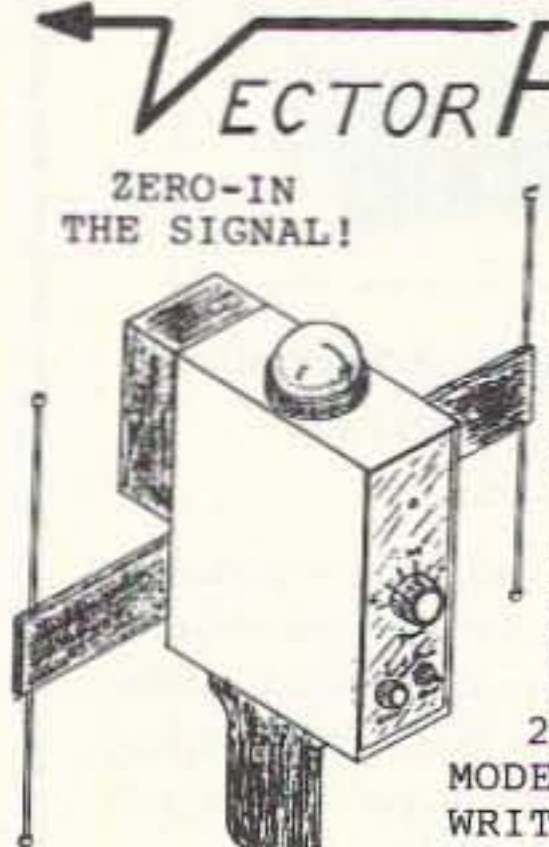
### Ring Out!

Resonance is a topic that seems to confuse many people. Articles attempting to explain it often resort to mathematical formulae and statements like "resonance occurs when the capacitive reactance exactly equals, and balances, the inductive reactance." That's completely true, but it doesn't tell you a thing about what resonance actually *is*. The phenomenon of resonance is at the very heart of radio communication, so let's take a look at it.

### Boiling

If you've ever played with a "Slinky" (and who hasn't?), you almost certainly can remember stretching it out and then flicking your end. The energy you imparted to it visibly deformed it in a moving wave down the spring until it reached the other end. It looked pretty cool, right? But what happened then? If you had the other end held rigidly to, say, a chair, the wave came right back at you, right? To me, that was always the niftiest part. Actually, it is exactly the

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same phenomenon as a bouncing ball; the energy is reflected by the rigid boundary.

The time it takes for the energy wave to make one complete round trip is called the *period*, and represents one complete cycle. If you measure that period in seconds, and then divide one by it, you'll get the frequency in cycles per second, or Hz, of the round-trip time. So, if you get a period of 0.8 seconds, your frequency is 1.25 Hz. And, in case you're wondering, no matter how hard you flick the spring, the frequency will be exactly the same. The wave will be *bigger* but not faster, because the transit time is not determined by the amount of energy thrown in.

#### By What, Then?

The time it takes for the wave to traverse the spring is determined by the length of the spring, its tension and the stiffness of the material from which it's made. Try stretching the string tighter; the wave's speed will increase. And, of course, if you shorten the spring, the energy has less distance to travel, so, even though its speed is not increased, it takes less time to make the trip.

#### Let 'Er Rip

Let's say you flick the spring, and then you flick it again at exactly the moment the reflected energy returns. What happens? The reflected energy,

which is going to reflect yet again towards the other end, adds to the new energy pulse, making it bigger. If you keep doing it, the wave will get absolutely huge. And that, gentle readers, is resonance.

#### Electrically Speaking

In an electrical system, energy travels through a wire at approximately the speed of light. That may seem

**"One very useful device in which the mechanical and electrical systems meet is the crystal."**

awfully fast, but it really isn't when you want to make millions or even billions of round trips per second. But the idea is the same—electrons have a fixed speed, and the length of the wire determines the transit time. But, you may be asking, why does the energy reflect back from the end of the wire at all? Well, the end of the wire represents an impedance boundary in much the same way as the spring's end represents a mechanical one. There's no place else for the electrons' energy to go, so it comes back at 'cha!

#### Reactance

Unlike in a mechanical system, though, the tension in the wire has no

effect on the electrons' speed. But, there are other factors. Specifically, there are capacitive and inductive reactances. Notice I didn't mention resistance here; resistance makes the energy weaker by dissipating some of it as heat, but it doesn't slow it down. If it did, we could make delay lines and information storage devices out of resistors, and it would take measurably longer for energy to reach the

other end of a 1 megohm resistor than it would for it to traverse a 1k resistor. It's a neat idea, but it just doesn't work.

By storing voltage charges in capacitance and current in inductance, though, we can, indeed, control the speed of the energy. And it's true, when the two kinds of reactance exactly equal each other in a parallel tuned circuit, they will cancel each other out, leaving only resistance, but with an overall slowdown of the energy. The result is resonance at a frequency determined by the sizes of the capacitors and inductors.

#### The Twain Meet

One very useful device in which

the mechanical and electrical systems meet is the crystal. Crystals actually do vibrate, but only very slightly. In doing so, though, they excite their atoms to produce electrical energy at the frequency of vibration. That frequency is determined by the physical characteristics, such as the size and type of cut, of the crystal. Because quartz (the most commonly used crystal material) has a molecular structure which is very dimensionally stable with respect to temperature, the frequency doesn't drift much. So, if we put a crystal in a circuit which causes it to excite itself at its resonant frequency, we've got one heck of a stable oscillator. In fact, without the stability of quartz crystals, electronics as we know it today wouldn't exist.

#### Skyhooks

Antennas are another resonant phenomenon. They're essentially the electrical equivalent of springs. The longer the wire, the more time it takes for the energy to make the round trip and the lower the resonant frequency. And, if we excite the antenna with energy that is *not* at its resonant frequency, the returning energy will interfere with, and partially cancel, the applied energy, resulting in an energy fight. We call that a "bad SWR!"

See you all next time. 73 de KB1UM. 73

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## Notes from FN42

I received a phone call from Richard Sears KC4IBC this past week. He was looking for some information on Taiwan which I was not able to supply to him, but he is going to be there for some time, and he promised to send us some noteworthy information about the happenings on Taiwan while he is there. I hope that he has a chance to chat with our Ambassador to Taiwan, Tim Chen BV2A.

If any of you have decided to travel around this great world of ours in 1994, you might want to read the letter from Nat VU2NTA in India and Harris 9M6HF in Malaysia. Nat is a tour guide and Malaysia has declared 1994 the "Visit Malaysia Year." Contact Wayne and tell him where you think he should go on his wide travels this year and ask him to take you too. I must admit that I keep telling him to take me along but he wants me to pay for it. I would think that he would want to pay my way just because I'm such great company, but, of course, that's just my opinion. I do know that he and Sherry would love to become your tour directors.

I was sure glad to hear from Harris Abdullah 9M6HF after a several-year "dry" period.

That's enough from me for this month. As usual, many great reports from other hams and your Ambassadors follow. If you like what they are reporting to us, let them know! If you want something else, let them know! If you have some new information, let them know! They are only as good as

those who provide them with information.—73, Arnie N1BAC.

## Roundup

**Egypt** This is just another reminder that Egypt is hosting TELECOM 94, 25-29 April in Cairo, which will focus on the African region. Africa TELECOM 94, which follows in the footsteps of Africa TELECOM 90 in Harare, will continue the dialogue generated by those events. The International Telecommunications Union (ITU) will once again provide a platform for continued discussion and presentation of the latest concepts for the development of telecommunications in the region. This event will bring together high-level personalities from the academic and industrial world and will thus be a unique opportunity for all the countries to meet with partners with an interest in the development of telecommunications.

The exhibitors will be displaying a range of advanced and high-quality items of telecommunications equipment and related services. The Forum, a cornerstone of TELECOM, will bring together top government officials and policy makers from around the world. This event is thus of vital importance from the point of view of broadening the participation of countries in development activities.

For further information, contact Mr. Tom Dahl-Hansen, Executive Director, or Ms. Suzan Hee-Sook Lee, Project Manager, ITU, Place des Nations, CH-1211 Geneva 20, Switzerland, Tel: +41 22 730 5811 or Fax: +41 22 730 6444 or Telex: +412 000 UIT CH, or the Government of the Arab Republic of Egypt contact person: Mr. Ismail Ouf, Chairman, Cairo International Conference Centre, Nasr Road, Nasr City, Cairo, Egypt, Tel: +202 263

4637/16 or Telefax: +202 263 46 40.

**India** Letter from Nataraj V., VU2NTA: Greetings from India. I have always enjoyed reading your "73 International" column as it gives us an idea of what amateur radio is doing in other countries. [Thanks, Nat!—Arnie] In India, amateur radio is growing by leaps and bounds. From less than 1,500 amateurs in 1979 to around 7,500 in 1993, it has been a big growth. But most licenses exist on paper as many amateurs find it difficult to get a decent station on the air due to the high cost involved. The cheapest transceivers available to the Indian amateur is the FT-840, which costs around Rs. 45,000, i.e. about \$1,500 U.S. This works out to be an average family's income for two years.

This has led to a huge effort in home-brewing, and many kits and ideas float around the popular bands in India—40m (7-7.1 MHz) and 20m. In South India, AM and CW have become very popular for home-brewers on 40m and SSB for those on 20m.

In spite of all this, what has gained popularity all over the country is 2m FM activity. 144-146 MHz is allocated to amateurs in India and major cities are seeing a spurt not only in 2m activity but 2m repeaters also.

Bangalore, in the south, was in 1987 the first 2m repeater in India open to all amateurs, followed by a second repeater in 1990. Next to follow was Madras with two repeaters. One repeater in each city is installed such that DX on 2m FM is possible and the other one is for use within the city. A third city to have two repeaters is Coimbatore in South India. Bombay, on the west coast, and Kodaikanal, a hill resort in South India, have one repeater each.

All this activity on 2m led to the starting of T-hunts (Fox Hunts, as they are known here). The first Fox Hunt in India was held on March 11, 1989. The Fox was Ganesh VU2TS. This hunt was won by Les VU2AK, Chandru VU2RCR, and Bhat VU2IFX, in a time of 45 minutes. There have been

seven Fox Hunts so far, the last one on September 5. Prizes for winners have ranged from storage water heaters for the bathroom to wall clocks, wristwatches, Walkman-type audio cassette players, and certificates for all the participants. All prizes have, so far, been sponsored by radio amateurs, including fellowship and lunch after the conclusion of the hunt.

The other cities that have had Fox Hunts are Madras and Coimbatore. Fox Hunts are the times when you find that all participants are crazy.

All sorts of antennae can be found during the Hunt. Unlike in most countries, hunts here have more participants on motorcycles than in cars or station wagons. One will find three- to five-element yagis, quads, loop yagis, phased verticals, and the latest was a half-wave dipole with a corner reflector on a 250 cc. motorcycle-sidecar combination by Poru VU2GGM.

Bangalore was also the first city in India in 1986 to have a multiple hill-topping expedition on 2m. As many as six hilltops in South India were activated.

I will try to make further information available to all. If anybody has specific questions, please drop me a line along with an SASE.

I wish all a Merry Christmas and a happy, prosperous and peaceful 1994. 73, Nat VU2NTA. [Nataraj V., 8, 100 Ft Rd; BSK 3rd Stage, 2nd Phase; 7th Block; Bangalore 560085, India.]

[Nat also wrote a letter to Wayne to discuss Wayne's travels. Following is that letter and Wayne's response.—Arnie]

Dear Wayne,

Over the years of reading 73 Magazine, I have found you travel around the world a lot along with your friends. How is it that you have not made a full-time tour to India? Is it that you could not find anyone to coordinate here for you or that you are not interested?

I have started a tour service for foreign groups and escort them myself. The tours in South India are by luxury coaches and have twin sharing accommodation at the best available hotels. For tours to North India, I do the ground handling but do not escort groups.

South India is vastly different. Every temple, fort, and palace is different, as is the culture, traditions, customs and life style in every village.

Do let me know if you would be interested so that I can customize an itinerary for you. South India is perhaps the most enchanting spot in India. The south includes the states of Maharashtra, Andhra Pradesh, Goa, Karnataka, Tamil Nadu, Kerala, and Laccadive Islands.

Unlike your other trips, it is not possible to get a reciprocal license to operate amateur radio but opportunities to meet radio amateurs and visit shacks will be arranged.

I look forward to hearing from you. With warm regards, Nat VU2NTA.

Continued on page 82



Photo A: Part of the gathering at one of the Indian Fox Hunts. Photo by VU2NTA.

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## 73 INTERNATIONAL

Continued from page 80

Nat... Been traveling—Caribbean islands, San Francisco, Munich, Berlin, New York, etc. I'm off to Hawaii this afternoon [26 Nov 93] for two weeks. Cold fusion conference.

South India, eh? Well, dunno—I've done the New Delhi-Agra bit, complete with forts. What might be interesting to a ham group? I've taken ham tour groups to Europe and Asia (Japan-Korea-Taiwan-Hong Kong-China), but what would we have to offer them in Southern India? And how many do I need to round up for Sherry and I to be tour directors? Presumably costs are low in India as compared to here, so what do you estimate for the cost of a 10-day tour?

No chance for licenses, eh? We shouldn't bring our HTs?

I organized a ham tour many years ago that included Lebanon, Syria, Iraq, Iran, Afghanistan, India, Nepal, Burma, Thailand, Singapore, Australia, New Zealand, New Caledonia, Fiji, Western Samoa, American Samoa, and Tahiti. Great tour! That would be fun to do again, but I haven't got the time these days. Next month I'm starting still another magazine. So what can you do in 10 days in India?

Best regards, Wayne.

Israel The Israel Amateur Radio Club invites all radio amateurs and SWLs to participate in the Holyland

DX Contest on the 2nd and 3rd of April 1994.

The object of the contest is to contact as many different Israeli amateur radio stations on as many bands and from as many areas as possible. It begins at 1800 UTC on the 2nd and ends at 1800 UTC on the 3rd. Each station may be contacted on both CW and SSB on the same band, which makes it possible to make up to 12 valid QSOs with the same station.

For further information contact Shalom Belcher 4Z4UT, IARC, PO Box 17600, Tel Aviv 61176, Israel (SASE please). [I will also try to get the entire rules on the 73 BBS in the "73 International" area (12), 603-924-9343, 300-2400 bps, 8N1.—Arnie]

### CANARY ISLANDS SPAIN

Woodson Gannaway N5KVB/EAB  
Apartado 11  
35450 Sta Marie de Guia (G.C.)  
Islas Canarias  
Espana

The NW Radio Club (our zone Guia, Galdar, etc.) is having its second annual Fox Hunt, but they changed the name to "Treasure Hunt." Fox Hunt might not have gone over too well here as the word "fox" in Spain has some questionable connotations. It's nice to see a little more activity up this way. And maybe the club on the next island (Tenerife) will start sending me some news. I hope

so. News from mainland Spain has dried up for now it seems. Maybe somebody there will take the "hint."

Most of you probably know that Europe depends heavily on bus transportation even though the number of cars is increasing rapidly. On the continent they also have trains, but we don't have any in the Canaries. The upshot of this is that I take the bus almost everywhere. Over the years this has led to some interesting events and conclusions, like about the character of different makes of busses.

In 1987, the only ones on the intercity line up here were Pegaso (Pegasus), old and tired, but still stout and willing. The terrain is mountainous and steep because the mountains are relatively recent and sharp-edged. That, plus frequent stops and starts, added to people with an impatient temperament, means that missed shifts and loose steering can be interesting. We have some pretty good grades and one approaches the second highest bridge in Europe (105 meters, 346 feet). I've watched drivers playing the loose steering on those bridges in a strong gusty crosswind and keeping well within their lane. This is doing more than it seems because everything is much closer and more critical in European driving than in the U.S. After six-plus years here I still have a tremendous admiration for their skill.

I also remember being in an old

Pegaso grinding up the approach to the bridges, standing in the aisle (58 seated, 30 standing) when it came time to downshift. No way; it just wouldn't go in, even with repeated trying. Meantime, the bus had really slowed down, but the only gear it would go into was the original one (fourth, I think). So we caught fourth but at a really slow speed, and went on up, even picked up a little speed! I watched several of the older passengers exchange knowing glances. It wasn't the first time they'd seen that happen. Those busses are tough, and still running after who knows how many years and probably millions of miles, because they're still used as spares.

Another time, we got stopped on the same hill—bad diesel fuel. It was just sprinkling rain, and I started talking to the driver about the rain. He said that with the older busses they had a lot of problems with the roofs leaking during the infrequent rain here. He said that at times he had to tell the people getting on and closing their umbrellas as they did, to leave them open because the roof leaked so badly!

This same driver saved my bacon one day. I had bought four heavy metal industrial shelves to take home on the bus. As I struggled up to the bus stop, there was the bus about to leave, across the very busy street. I'm pretty good at getting across busy Las

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Palmas streets when I need to, but not with a cumbersome load like that. But I looked up and there was Marco at the wheel, so I call, "Marco!" He looked up. "Wait for me." And he settled back into the seat, ready to wait as long as it took me to get across. This would never happen on the line that serves the south, the tourist part of the island. I'm sure glad I live in the north.

Until next time, 73. Woodson N5KVB/EA8.

## MALAYSIA

Harris Abdullah 9M6HF  
PO Box 13329  
88837 Kota Kinabalu  
Sabah  
Malaysia

I operated a BBS station on 2m for a month last April with a high expectation of getting others to try out this mode, but I managed to get only two amateurs interested. In the daytime, the BBS was on HF and downloading bulletins and mail from YB5QZ BBS on 20m, and in the evenings it was on 2m. But it was fun, and the experience gained will be put to good use when a BBS runs full-time here in the future.

The next project is the setting up of a P/C cluster here. JH1ROJ/9M6RO has contributed the software and TNC (DRSI-2). I will be operating the cluster and hopefully this new project will attract the others to go into the packet mode.

The 73 Hambassador from Hong Kong, Phil VS6CT, made a short visit here last April and was kept busy by the local hams. Phil made several presentations to various groups on his specialty—Maritime Distress and Safety Systems.

VS6CT is always on 21.227 MHz daily from 2300 UTC. Sometimes he is joined by HL9KT, BV2FA, KA6V (Phil's QSL manager), WB2KXA (from New Jersey), and myself. HL9KT and myself have a regular sked on 14.195MHz at 0900 UTC. If any of you wish to join in, please do so when you hear our signals.

Two new operators, Din 9M6LS and Armstrong 9M6BZ, check in regularly with the W7PHO Family Hour Net on 14.226 MHz. So does Johnny 9M6DB located in Miri, Sarawak.

JA9AG, a JARL Director for the "9" call area in Japan, came twice:

November 1992 and February 1993. He operated 9M6/JA9AG at a place called Seaside Resort about 20 km from Kota Kinabalu.

1994 has been declared "Visit Malaysia Year." Those who have not made their holiday plans yet may con-

sider a visit here. Temporary operating permits could be arranged if you desire to operate from here. Let me know via Packet Mail @J13ZAG in Osaka, Japan, or drop me a line at my address.

73 from Malaysia!

73



Photo B: Hambassador Phil Weaver VS6CT while visiting Hambassador Harris Abdullah 9M6HF.

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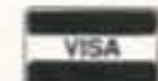
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# SPECIAL EVENTS

Number 22 on your Feedback card

## Ham Doings Around the World

FEB 5

**CHARLESTON, SC** The 21st annual Charleston Hamfest/Computer Show will be hosted by the Charleston ARS at Charlestowne Landing State Park from 8:30 AM-4 PM. Talk-in on 146.79- or 145.25-. VE Exams at 12 noon - Talk-in on 145.25- to get location. Walk-ins only. For Exams, contact Ed KC4OOZ, (803) 871-4368; or Warren W4ZYZ, (803) 572-1164. Flea Market Contact: Jenny Myers WA4NGV, 2630 Dellwood Ave., Charleston SC 29405-6814.

FEB 13

**MANSFIELD, OH** The Mansfield Mid-Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds beginning at 7 AM. Talk-in on 146.34/.94 (W8WE). For tickets/info contact Pat Akerman N8YOB, 63 N. Illinois Ave., Mansfield OH 44905. Tel. (419) 589-7133 after 4 PM EST. Send SASE with payments or inquiries by mail.

**VANCOUVER, B.C., CANADA** The Burnaby ARC will host their annual Flea Market at the Westminster Armouries, 6th St. at Queens, New Westminster BC. Doors open for sellers at 0900 hrs; buyers 1000-1400 hrs. Talk in on 145.35 (VE7RBY), or 442.85. For info, contact the club net, Monday nights at 2000 local time on 145.35; or write Burnaby ARC, Box 72012, 4429 Kingsway, Burnaby B.C. V5H 4P9, Canada.

FEB 19

**SALEM, OR** The Salem and Oregon Coast Emergency Repeater Assns. will co-sponsor the 1994 HAM FAIR, beginning at 9 AM at the Polk County Fairgrounds. Talk-in on 146.26/.86. For info write (with SASE) to Salem Repeater Assoc., P.O. Box 784, Salem OR 97308.

FEB 20

**BRIGHTON, CO** The Aurora Repeater Assn. will hold its 12th annual Swapfest at the Adams County Fairgrounds at 9755 Henderson Rd, from 8:30 AM-2 PM. Contact Judi WD0HNP, (303) 450-6910, or Jan KA7TYU, (303) 699-1944;

or write (with SASE) to Aurora Repeater Assn., P.O. Box 39666, Denver CO 80239.

**CUYAHOGA FALLS, OH** St. Vincent's Bingo Hall, 3479 State Rd., is the site for a HAMFEST being sponsored by the Cuyahoga Falls ARC. Contact (216) 929-4267, or Carol Hervol N8JLQ, 11192 Cottingham Circle NW, Uniontown OH 44685. Tel. (216) 497-7047.

FEB 26

**BISMARCK, ND** The Central Dakota ARC will hold its annual Hamfest at the Radisson Inn, 800 South Third St., from 8 AM-4 PM. Talk-in on 146.85/.25. VE Exams. Ham/Computer Swapmeet. Get details from Tim N0SDB, (701) 663-6620; or Chris N0POK, (701) 663-1324.

**JENSEN BEACH, FL** The Stuart Outdoor Hamfest, sponsored by Martin County ARA, will be held at Langford Park, S.R. 707, at "The Arch," from 0800 UTC-1500 UTC. Talk-in on 147.060 (+600 MHz). Packet Demo. ARRL VE Exams begin at 9:30 AM (courtesy of Ft. Pierce ARC). Sign in at 9 AM. Contact MCARA, P.O. Box 1901, Stuart FL 34995; or Bob Hess KA3EDL, (407) 546-4353.

FEB 26-27

**CINCINNATI, OH** The ARRL Great Lakes Div. Convention 1994 will be held at the Cincinnati Gardens Exhibition Center, 2250 Seymour Ave. Exhibits open at 8:30 AM Sat. and Sun. Commercial vendors and Flea Marketeers are welcome. Convention Chairman: Stan Cohen WD8QDQ, 2301 Royal Oak Ct., Cincinnati OH 45237; (513) 531-1011. Vendor Chairman: Joe Halpin W8JDU, 11615 Geneva Rd., Cincinnati OH 45240; (513) 851-1056.

FEB 27

**DEARBORN, MI** The Livonia ARC will hold its 24th annual Swap'n Shop from 8 AM-4 PM, at the Dearborn Civic Center. Talk-in on 144.75/5.35 and 146.52 simplex. VE Exams will be given in the afternoon of the Swap. For info, send 4x9

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by December 31. Provide a clear, concise summary of the essential details about your Special Event. Check Special Events File Area #11 on our BBS (603-924-9343). For listings that were too late to get into publication.

SASE to Neil Coffin WA8GWL, Livonia ARC, P.O. Box 2111, Livonia MI 48151. Tel. (313) 427-3905.

MARCH 5

**ABSECON, NJ** The Shore Points ARC will sponsor its 12th annual hamfest, "Springfest '94", at Holy Spirit H.S., Rte 9, 1/2-mi. south of Rte 30. Doors open at 9 AM (7 AM for sellers). Talk-in on 146.385/.985. Contact SPARC, P.O. Box 142, Absecon NJ 08201.

**DENVILLE, NJ** The annual North Jersey Hamfest, sponsored by Split Rock/West Morris, will be held on Morris Ave. starting at 8 AM (sellers 6 AM). VE Exams at 9 AM sharp. Sign up by 9 AM. Talk-in on 146.985 and 223.86. Contact Bernie WB2YOK, P.O. Box 251, Flinders NJ 07836; (201) 584-4423.

MARCH 6

**NORTHAMPTON, MA** The Smith Vocational School on Rte. 9 has been chosen as the site for the 10th Annual MTARA Amateur Radio Flea Market. This event will be presented by the Mt. Tom Amateur Repeater Assn. Inc., starting at 9 AM (8 AM for vendors). ARRL VE Exams at 10 AM. Vendor Reservation Contact: Jim K1MEA, (413) 527-3199 eves. before 2200 EST. VE Exam Registration: Jim WA1ZUH, (413) 245-3228; or @ MTMBBS via packet. Advanced registration strongly recommended.

### SPECIAL EVENT STATIONS

FEB 12-13

**EUGENE, OR** A CW QSO Party will be held by the Quarter Century Wireless Assoc. Inc. from 0000 UTC Sat.-2400 UTC Sun. Frequencies: 30 kHz inside the CW bands. Regular call signs will be used for all contacts. Send logs to Bob Reed WB2DIN, 597 Brewers Bridge Rd., Jackson NJ 08527. For more info, contact Bill Miller K2GCE, Activities Manager, 217 Porterfield Pl., Freeport NY 11520.

**EVANSTON, WY** The Uinta County ARC will operate NW7H 1500Z-2400Z to celebrate the Chinese New Year. Phone 10X on 28.395, 24.945, 21.325, 18.140, 14.245. For a certificate, send QSL with a 9x12 SASE to Vranish, P.O. Box 2048, Evanston WY 82931-2048.

FEB 12-14

**CLAREMONT, NH** The 1994 New Hampshire QSO Party, sponsored by the NH ARA, will take place on Feb. 12th from 1900 UTC-0700 UTC; Feb. 13th, from 1400 UTC-0200 UTC Feb. 14th. Open to all classes. Techs w/o HF privileges are invited to join on simplex above 50 MHz. Operating frequencies: CW—1810, 3535, 7035, 14035, 21035, 28035. SSB—1875, 3935, 7235, 14280, 21380, 28320, 50115, 144205. FM—29.610, 52.540, 146.550, 223.500, 446.000, 902.100, 1296.100. There will be a 75 meter phone finale Sun. on 3950 +/- QRM. Logs must be post-marked by March 31, 1994. Contact Conrad Ekstrom WB1GXM, P.O. Box 1076, Claremont NH 03743-1076. Please send SASE.

FEB 18-20

**MARQUETTE, MI** The Hiawatha ARA will operate N8GBA 1700Z Feb. 18th-1700Z Feb. 20th, to honor the Up 200 Sled Dog Championship. The Lower end of the 10, 15, 20 and 40 meter phone bands will be used. For a certificate, send a large SASE with 2 stamps to Richard Schwenke N8GBA, 21 Smith Lane, Marquette MI 49855.

FEB 19-20

**MOUNT VERNON, VA** The Mount Vernon ARC will operate Station N4BV during the hours of 1600Z-2000Z on 19-20 Feb., to commemorate George Washington's birthday. Operations will take place from George Washington's home. Frequencies: The lower General 80m-15m subbands, and on the Novice 10m subband. For a certificate, send QSL with a 9x10 #10 SASE to Steve Schneider WB4EEA, 8602 Cushman Place, Alexandria VA 22308.

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CIRCLE 251 ON READER SERVICE CARD

84 73 Amateur Radio Today • February, 1994

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The NETRIX Diode Matrix Board connects TNCs together to form a network switching node, where packets are routed towards their final destination. It uses six DE-9F connectors, needs no expensive cables, and works with TheNET and ROSE networks. \$24.95 as a kit, \$39.95 assembled. Adapters for DRSI or MFJ TNCs are only \$2.49 each - specify.

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CIRCLE 243 ON READER SERVICE CARD

## NEVER SAY DIE

Continued from page 4

cently evolved system they've found a much more primitive analog communications system which is still with us. This involves communications about damage to the body and operates on micro-currents. It's a fascinating detective mystery, where Becker has dug out past research data which didn't make sense at the time and put the puzzle together.

Then he gets into how all life has evolved in the Earth's magnetic field and how magnetic fields influence every cell. The micropulsations in the Earth's magnetic field are strongest at 10 Hz, the frequency at which many of our brain functions occur. Becker shows how electromagnetic energy systems within the body control growth and healing, regulate the level of activity of the brain, and produce vitally important biological cycles by deriving timing information from the natural electromagnetic environment of the Earth. He shows that there is a relationship between the Earth's geomagnetic field and human behavior. Further, it's been shown that the conscious mind can control the level of activity in the body's DC control systems. This helps with our understanding of how changes can be brought about by the use of visualization, hypnosis, meditation, biofeedback, suggestion, placebo, and religious experiences.

Some yogis are good at this, but more research is needed before the rest of us will be able to use this enormous power. If the placebo effect could be bottled it would be worth billions. Placebos have been shown to be able to work in 60% of clinical cases, so we're not talking chopped liver.

How do healers work? It isn't the placebo effect, because they're able to be as successful with animals as people. So what then? And how can those super-diluted homeopathic remedies possibly work? Scientific orthodoxy says it's impossible, so the scientists get all upset every time a double-blind research project shows success. It's impossible, so they don't want to even know about it. They argue that there must be some fault in the research. But then other labs come along and report the same findings.

We're dealing with extremely sensitive biological chemical and electromagnetic systems. For instance, a male moth sensing one single molecule of a female pheromone will fly toward her. This process involves the transfer of but a single electron!

### Zapping Drug Addictions

A small voltage stimulation unit is popular for sports medicine and is even being used by jet-fighter pilots to prevent backache from their cramped cockpits. Another has been amazingly successful in helping people cure drug habits—without withdrawal symptoms. Further, the people had a personality change from an addictive to a non-addictive type.

Then there's the use of small volt-

ages and magnetic fields to help bones mend. These same currents can cause cancer cells to have explosive growth. In 1880 a doctor reported that a patient with cancer of the lip and chin had been struck by lightning and his cancers disappeared within a few weeks, nor did they return during the following 10 years. That treatment is a little rough, so perhaps it's time to see just what it does take. Becker reports on the recent research in this field, showing that even at very low power, microwave energy can have a number of extremely undesirable effects.

How about the Amazon Indians who treat snakebite by touching it with a wire from the spark plug of an outboard motor, giving it a low-current, high-voltage zap? This seems to inactivate the toxin. Otherwise-fatal bites are survivable with this technique.

Becker shows how solar flares affect the Earth's magnetic field and how this correlates with mental hospital admissions. He wonders if it is just a coincidence that past species extinctions coincided with gravity field reversals.

Then he gets into man-made fields and their effect on all life—including us. Doctors in Houston found that the children of fathers who'd been exposed to electromagnetic fields (EMFs) at work had an increased risk of having children with brain cancer before the age of two. Exposure to microwaves and any other man-made electromagnetic fields (such as 60 Hz) produces stress, a decline in the immune system, and changes in the genetic system (none beneficial).

### Can Our PL Tones Cause Genetic Changes?

The body is quite capable of demodulating radio signals of any frequency and the biological effect is the same as those produced by low frequencies—just in case you haven't been concerned about what those handie-talkie PL tones may be doing to you. Becker quotes one of the leading researchers in this field, Ross Adey K6UI.

There is a good reason to suspect that the virtual explosion of cancer in the last two decades may be due to EMFs. Since 1975 lymphoma, myeloma, and melanoma have increased by 100%, breast cancer by 31%, testicular cancers by 97%, kidney cancer by 142%, colon cancer by 63%, and so on. Is that enough to make someone think?

Work is just starting in the extremely low frequency (ELF) field. It turns out that the brain is extraordinarily sensitive to very low levels of ELF. The government has discounted the emerging research reports because they simply can't be true.

We're using nuclear magnetic resonance (NMR) units in hundreds of hospitals, yet yeast cells exposed to NMR multiply at twice their normal rate and their offspring are half as large as normal!

We know that all substances are magnetic to some extent, because the spin of the electrons around the nucleus produces a magnetic field. Some people are so sensitive to magnetic fields that

just being near a TV or computer terminal causes their skin to turn red and brings on flu-like symptoms. Are the rest of us totally immune? Not bloody likely.

The power companies, appliance manufacturers, broadcast stations, and the military have enormous vested interests in the public not finding out about how their fields are affecting us. Scientists who have persisted in publicly raising the issue of harmful effects from any portion of the magnetic spectrum have been discredited and their research grants taken away. Paul Brodeur's books on the subject have documented this, even citing how much some named scientists were paid by the power companies to testify on their behalf when questions were raised. It almost reminds one of the tobacco and asbestos denials.

I think you'll enjoy the book. It's written so you won't have any problem understanding it and it goes into a lot of fascinating detail. I don't think you'll allow any family member to use an electric blanket again, and you may decide to move your linear amplifier across the room where it isn't as close to where you operate.

Now do you see why I found this book so interesting and am trying to get you to read it? It will open a whole new world for you—starting you looking for more information and perhaps even getting you interested in doing some research yourself.

Next I want to review a book by T. Srinivasan, an interesting chap I met recently at a Subtle Energies Conference in Monterey. This is a collection of 28 papers presented at the 1987 Energy Medicine Conference in Madras, India. I'm encouraging Srinivasan to bring out a new edition, but with the material presented in a more reader-friendly form. Scientific papers are usually very difficult to follow, and it's a shame for this important material to be buried for the lack of a simple English translation.

Then there's *The Secret Life of Plants*, by Tompkins and Bird, which raises a whole bunch more questions. And have you read *Electromagnetic Man* by Smith and Best yet? Tsk! Your mind isn't much good to you if you don't give it data to work with, and that garbage on TV you've probably been wasting your time on doesn't count for much as data. We'll have a lot more to talk about on the air if you've read some books. Then you won't have to depend on ignorance to guide you, like the two hams I cited.

### A Cure for AIDS?

The way the Lambda homosexual ham club has been spitting in my face, so to speak, and apparently doing their best to hurt 73 ad sales, I've had a short wrestling match with myself over this HIV virus thing. They're mad at me because a militant opportunist in their group has latched onto a flimsy pretext to bring what I consider a frivolous suit against the ARRL for refusing to run their ads in *QST*, and I'm vigorously opposed to bringing lawyers and lawsuits into ham doings. The last I heard, magazine publishers are permitted to refuse

any ads for any reasons, stated or unstated.

Now, I'm not suggesting for one minute that all homosexuals are pedophiles, but we've had more than enough of them preying on young hams and the children of hams without opening the door further. Indeed, two very well-known hams have been arrested and convicted of this. Well, enough of my grousing about child molestation. I'd probably shut up if Mike Kelly, the strident voice of Lambda, would stop doing his best to give me free publicity for my opposition to his stupid lawsuits.

Yes, I've said and written that I consider any ham scum who resorts to lawsuits in our hobby. This is supposed to be a hobby, and it's supposed to be fun. When hams get so wrapped up in the hobby that they start lawsuits, their perspective is awack. Kelly can unscum himself, at least to my satisfaction, by dropping the Lambda lawsuit against the ARRL and reimbursing the League for the money (our money, by the way—money that comes from our membership dues) that he's wasted for us with his push to get his homosexual ads in *QST* and, of course, personal promotion for himself.

Now, about AIDS which, if you've read much about it, is almost totally a homosexual problem. The good news is that there seems to be a simple cure for the HIV virus. The even better news is that we hams are in a wonderful position to help. I'm not sure why news of this incredible breakthrough hasn't been a cover feature on *Time* and *Newsweek*, but I expect it will be, once a few journalists finally realize what's been just recently discovered.

I've an advantage in this case because of my interest in the research into the effects of low level electromagnetic, radio, and electric fields on cells, and their connection to cancer and a wide variety of other illnesses. Then there's the amazing research which has been done by Robert Becker in *Cross Currents*. He explains how currents in the microampere range can have powerful effects on cells.

Having recently read *Energy Medicine* and *Vibrational Medicine*, I was not surprised to read that some researchers at the Albert Einstein School of Medicine in New York have discovered that a current of about 50 microamperes can alter the outer protein layers of the HIV virus and thus prevent its subsequent attachment to receptor sites. This was reported in *Science News*, March 1991, page 207. Well, if you've done any reading at all in molecular biology, you know this is the breakthrough we need to start getting rid of HIV.

In my review of *Cross Currents* I mentioned that Amazonian Indians have been able to detoxify deadly snake bites by zapping the bite with a wire from their outboard motor spark plug. The HIV virus can be similarly zapped and the equipment needed to do this is something any ham should be able to build.

Further, if you've been paying atten-

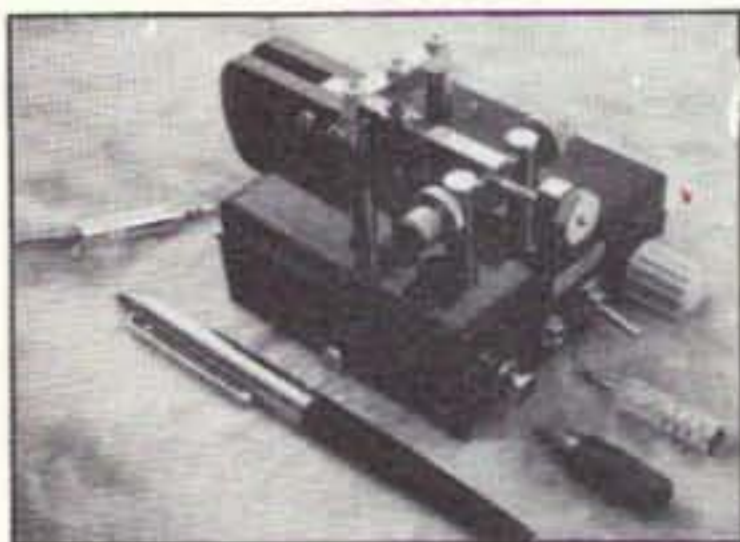
Continued on page 87

# NEW PRODUCTS

Number 23 on your Feedback card

Compiled by Charles Warrington WA1RZW

## G4ZPY PADDLE KEYS INTERNATIONAL



The first commercially produced single-lever combo keyer has been introduced by G4ZPY Paddle Keys International. This new beauty has a little something extra—if you get tired of using the single lever and want to

switch over to a twin lever, there is a jack socket fitted to enable another keyer to use the same iambic electronic keyer.

The new combo may be purchased in four different finishes, and all are fitted with keydown switches. This brings the G4ZPY collection to 50 keyers—the largest selection in the world!

All keyers are handcrafted, so they take longer to produce. For more information, send an SASE (UK) or two IRCs to G4ZPY, 41 Mill Dam Lane, Burscough, Ormskirk, Lancs., England L40 7TG; Tel/Fax 44 (0) 704 894299. Or circle Reader Service No. 201.



## S & S ENGINEERING

The newest in the ARK Series of synthesized QRP transceivers, the ARK 20, is a rugged unit perfect for Field Day, DXpeditions, camping trips, business trips, or the home shack. Lightweight and portable, the unit measures 2-3/4" x 5-1/2" x 8", weighs less than four pounds, and comes with a tilt-up handle-bail.

## AMECO CORPORATION

All the latest changes in FCC amateur radio test preparation requirements are incorporated into the new, revised editions of Ameco's popular license manuals. Separate manuals are available for the Novice Class (Cat. #27-01), the Technician Class (Cat. #28-01), and the new No-Code Technician Class (Cat. #78-01).

Each book covers all the FCC examination questions for each class, with corresponding multiple-choice answers. There is a clear, concise explanation for each correct answer, which helps the reader fully understand the theory and concept behind the question. All questions and answers are conveniently ar-

The transceiver covers the CW portion of the 20 meter band and tunes in 100 Hz steps. RIT and a 200-Hz-wide audio filter are also selectable from the front panel.

The kit is complete with all parts, silk-screened front and rear panels, and an extruded, anodized aluminum case. The transceiver operates from 11 to 13.8 VDC and provides 3 to 4 watts of RF power. The output power is adjustable to the milliwatt level. Breadboard area on the transceiver PCB makes adding your own favorite optional circuits easy.

The ARK 20 kit price is \$269.95. For more information or to order contact S & S Engineering, 14102 Brown road, Smithsburg, MD 21783; (301) 416-0661. Or circle Reader Service No. 204.

ranged to minimize flipping pages.

These books are by Mr. Martin Schwartz, who has over 40 years experience writing amateur radio license instruction materials. You can purchase the Ameco books from your local ham radio dealer, or contact Ameco Corporation, 224 East Second Street, Mineola, NY 11501; (516) 741-5030, Fax (516) 741-5031. Or circle Reader Service No. 206.



Micro-Ohm Measurements has announced the new Ohm Extender—a device that will give your DMM a new depth of operation. The Ohm Extender is a portable battery-operated adjunct, which uses your digital multimeter as a readout.

The Ohm Extender gives you the



## OPTOELECTRONICS

A new low-cost communications decoder with advanced features has been announced by Optoelectronics. The Model DC440 reads 50 subaudible (CTCSS) tones, 106 digital (DCS) codes, and 16 touch-tone (DTMF) characters simultaneously! Applications include: two-way communications testing, repeater monitoring, and security and

surveillance monitoring. It can also be used to update older service monitors and to enhance recreational monitoring.

The DC440 displays decoded information on a two-line alphanumeric liquid crystal display. Unique to the DC440 is the serial data jack that permits connection to a PC serial port using the model CX12 RS-232C interface. There is a complete set of control codes to permit remote operation from a PC. Optional NiCd batteries provide up to five hours of portable operation.

The price for the DC440 is \$259. For product assistance, further information, or to order, contact Optoelectronics Inc., 5821 NE 14th Avenue, Ft. Lauderdale, FL 33334; (800) 327-5912, Fax (305) 771-2052. Or circle Reader Service No. 202.

## TRIPP LITE

Tripp Lite has introduced a new product that is perfect for ham shacks equipped with PCs and PC clones. The new Power Miser combination screen monitor and surge suppressor saves electricity by automatically turning off power-hungry computer monitors. Keyboard activity instantly restores the monitor to its prior screen.

The Power Miser is also a high-quality four-outlet surge suppressor with superior spike and noise line filtering for connected equipment. It pro-

vides 720 joules of surge suppression and excellent RFI and EMI noise rejection.

The Power Miser has a retail price of \$99.95 and can provide savings of up to \$190 a year. For further information contact Tripp Lite, 500 N. Orleans, Chicago, IL 60610-4188; (312) 329-1777, Fax (312) 644-6505. Or circle Reader Service No. 203.



## HAMBREW

Hambrew, a new magazine devoted to amateur radio builders and designers,



is now being published quarterly for hams around the world. The focus ranges from beginner-level kit building to more advanced RF design, with some theory sprinkled in. Articles in the inaugural Autumn

1993 issue included a Ramsey 30 meter transmitter review, constructing foam-core panel cases and cabinets, the NorthWest QRP 30-30 Transmitter, and decoupling loops for dipoles with a discussion of counterpoise.

Classified ads are free to both commercial and non-commercial subscribers. Subscriptions are \$20/yr. domestic, \$30/yr. Canada and Mexico, and \$35/yr. elsewhere. For more information contact Hambrew, P.O. Box 260083, Lakewood, CO 80226-0083; (800) 5-HAMRIG. Or circle Reader Service No. 205.

## FB ENTERPRISES

FB Enterprises is now offering the 1994/95 edition of their popular "Repeater Maps." These maps are available for all US states, Canadian provinces, Central American countries, and Caribbean islands. (California is split into Northern and Southern California, so please specify when ordering.)

The updated maps show 2 meter repeaters in full color on the front of the card, and the bands between 220 MHz and 1.2 GHz are in black and white on the back. They include autopatch information and CTCSS tones for those repeaters which use them.

The maps are 5-1/2" X 8-1/2" and



are laminated in clear plastic. They retail for \$3.95 and are available at your ham radio dealer or directly by mail order. Catalogs are available for \$2 (refunded with purchase). For more information contact FB Enterprises, 23801 NW 1st Ave., Ridgefield, WA 98642-8830; Voice/FAX (800) 377-2339. Or circle Reader Service No. 207.

## MICRO-OHM MEASUREMENTS

equivalent of an expensive milli- and micro-ohm meter, which would cost 10 times as much. You can actually measure shunt resistors; precisely measure wire length; verify circuit board trace resistance; read motor, transformer, and choke values; and check switch and relay contacts.

All components are of the finest quality and there is a one-year limited warranty. The price is \$161 ppd. For more information contact Micro-Ohm Measurements, P.O. Box 460, Brookshire, Texas 77423; (713) 934-4659. Or circle Reader Service No. 208.



## NEVER SAY DIE

Continued from page 85

tion to the news, you know that some German blood banks have been careless and allowed HIV virus to get into their supplies. Now we know how to easily and quickly cleanse any blood of the virus.

A physicist friend of mine gave a lecture on this new procedure to a group of doctors at a recent symposium and they gave him a standing ovation. But I suspect the pharmaceutical companies are going to be extremely upset over this development. There are no drugs involved. The drug companies have been investing millions in search of a magic drug to counter HIV—and have gotten nowhere. It's probably fitting, in a way, that the solution to this scourge can be cured by some electronic equipment which costs well under \$100 to make. Simple stuff.

The normal medical electronic industry approach would be to put the simple circuits involved into an impressive box, add a bunch of meters, and charge \$10,000. And it would be worth it. The fact is that there's nothing more required than parts you can get at almost any radio parts store.

What about side effects? There aren't any. As far as I can see, this approach should be able to eliminate the HIV virus within a few days for anyone infected with a simple and completely non-invasive treatment. Of course,

since the equipment involved is not FDA approved, you can't make it and sell it to doctors. If they bought it, they wouldn't be allowed to use it. But you are allowed to experiment with it, even on friends. And doctors are allowed to do research with it, as long as they've built the equipment themselves. Thus there is going to be one heck of a market for Heathkit-like kits for experimenters and doctors.

There are two pieces of equipment involved. One passes a microampere current through the vascular system, cleaning out the HIV virus in the blood. The other generates a short and very powerful magnetic field to flush the virus out of the lymph glands, where it tends to hide, and into the vascular system, where it can then be eliminated.

If you've done any homework on how cells work and the effects of microcurrents on them, you'll understand the beauty of this approach—and why researchers have failed to discover it for so long. The labs, largely funded by pharmaceutical companies, have been looking for a chemical cure—one they can sell. There's been little funding for nontraditional approaches. Indeed, the orthodox scientific community routinely suppresses research like this and does its best to cut off all possible funding sources. In this case all it took was one non-traditional physicist to see the implications of the Albert Einstein College discovery and develop the hardware needed. He used to be a ham, but got so involved with research that he let his

license lapse.

What happens is that when a small current flows through the vascular system it hits the HIV virus and causes it to lose its ability to make an enzyme crucial to its reproduction. Then the white cells can no longer clump together, and the virus is terminated. Using this approach it will also be simple to quickly cleanse infected blood banks, thus preventing further HIV infections from transfusions.

If there is any real 73 reader interest in this I'll consider printing the circuit diagrams of the two simple units, along with detailed instructions on their use. If I get less than a thousand requests, I won't bother. I certainly don't want to take up valuable space in 73 for non-ham-oriented construction articles that not many readers want to read about. That wouldn't be fair to the other readers. Mind you, if I do print the construction plans, I'm not making any medical claims. I don't need to have the FDA or any other government agents making my life miserable. Anything you build is completely between you and yourself. And anything you do with it is strictly experimental. I'm just a journalist reporting what I've heard and read.

Experimenters have shown that it takes about three weeks, using the equipment a few minutes a day, for a complete HIV remission.

Will we be seeing headlines about this? Eventually, but you read it here first.

So what's next? How about a simple

electronic approach to drug addictions? Any interest? No, probably not. I expect I'll get the usual letters asking me to stop writing about stuff like this and stick to ham radio topics in a ham radio magazine. Like *QST* does. But yes, there is good reason to believe that another fairly easily-built piece of electronic equipment could zap even the most vicious of drug habits.

Religious fanatics may be upset with me over all this. I've talked with several on the air who are absolutely convinced that AIDS has been sent as a curse by God as retribution for the homosexual lifestyle. Unfortunately they haven't convinced me that their pipeline to God is any better than mine. And I wonder how much Kelly is considering the rights of homophobes as he pursues his own demons and his personal quest for power via gay militancy.

It doesn't seem to have occurred to Kelly that anyone who is not stridently pushing for gay rights can be anything but a homophobe. Go back into the closet, Kelly, and shut the padded door behind you.

### Ordering Books and CDs

[Editor's Note: Wayne often references books and CDs in his editorials. The books are often available from Uncle Wayne's Bookshelf; the CDs from IMPS by Mail. Both can be ordered by telephoning (800) 234-8458 or (603) 924-4196, or by faxing (603) 924-8613.]

73

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# PROPAGATION

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during daylight hours. Although the band "dies" an hour or two after local sunset, these hours may be the very best for DX and grey-line propagation along the day/dark terminator.

The 40 meter band tends to "peak" for DX toward Europe and Africa in the late afternoon and early evening, and toward the Pacific in the morning around sunrise. This band will stay open long after dark for short skip, which usually prevails during daylight hours.

The 80 meter band may be your best lower HF band for DX between sunset and sunrise, peaking around midnight (local time) and again around sunrise. Noise levels should remain low until late in the month when springtime storms occur more frequently. Short-skip conditions at night will open out to 2,000 miles or so.

The 160 meter band will not be open during daytime, but will be very good after dark, and DX ought to peak around midnight local time. Short skip at night during early evening hours will be quite good out to 1,500 miles or so. Look for DX also around, or just before, local sunrise, toward the west, south and other directions. 73

This month is considered an "in-between" month and exhibits some winter and some spring "conditions" on the HF bands. Although 1994 will be a year of fewer sunspots than the past eight or nine years, it will still permit excellent DX propagation on the days marked "G" on the calendar but, as usual, this will depend on the band you choose. Winter conditions of low noise and good nighttime propagation on 80 and 160 meters will continue this month, but atmospheric noise will increase as the equinox in late March approaches. The poorest days for DX are likely to be those surrounding the 8th and 21st of the month. The best days for DX will likely be those marked with a "G" (Good) and "F" (Fair), or trending between F and G. On the Poor days keep an eye on other geophysical conditions, such as storms and high winds with much snow in the north and rain or sleet in the south. Geological disturbances are more likely on or near the "P" days, if they appear at all. Stations with better antennas and receivers are likely to fare better in times of low sunspot activity as the maximum useful frequencies also decline, and hours of good DX are shorter than ever. Some F2 openings may last for only an hour or so on the 10 and 12 meter bands as the MUF rises above 28 MHz. Choose the "G" days for your best opportunities. Short skip will prevail on the days these bands are open.

On the 15 and 17 meter bands, you may find DX opportunities quite good with afternoon (local time) hours being better than morning hours, and short skip should continue during most daylight hours, but the band will close around dark.

The 20 meter band is always our most reliable DX band, and is even more so during times of low solar activity. Peak conditions occur shortly after sunrise, and again in the late afternoon, and should provide the best signals to distant locations. Short skip will prevail during daylight hours out to about 2,000 miles or so. North-south paths will open shortly after dark, as well, with excellent propagation on Good days.

The 30 meter band exhibits some of the behavior of 20 and 40 meters. You can work DX on many days around sunrise and sunset, with short skip prevailing

### EASTERN UNITED STATES TO:

GMT.	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15						20	20A	15			
ARGENTINA	20										15	15
AUSTRALIA	20					40	40				20	20
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	80	80		20	15	15	15	20	
HAWAII	20					40	20	20			15	15
INDIA							20	20				
JAPAN	15						20	20				15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES							20	20				
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40						15	15	20		
U.S.S.R.		40						15	15	20		
WESTCOAST	15	20	40	40	40	40	40A	20A	15	15	15	15

### CENTRAL UNITED STATES TO:

GMT.	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20					40	40	20	20			20
ARGENTINA	20	40	40	40							15	15
AUSTRALIA	15						40	20	20	20	15	15
CANAL ZONE	20	40	40	40	40						20	15
ENGLAND	40	40	80	80							15	15
HAWAII	20	20				40	40	20	20	20	15	15A
INDIA							20					
JAPAN	20					40	40	20	20			20
MEXICO	20		40	40	40			20	15	15	15	15
PHILIPPINES	20						20	20				
PUERTO RICO	20		40	40	40			20	15	15	15	15
SOUTH AFRICA	20	40	40						15	15	15	20
U.S.S.R.		40	40						15	15	20	

### WESTERN UNITED STATES TO:

GMT.	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	15	20				40	40	40			20
ARGENTINA	20	20		40	40						15	15
AUSTRALIA	15	15	20					40			20	20
CANAL ZONE	20	20		40	40	40	40	40	15	15	15	15
ENGLAND			40	40					20A	20A		
HAWAII	15	20	20			40	40	40				15
INDIA		20	20									
JAPAN	15	15	20				40	40	40			20
MEXICO	20	20		40	40	40	40	40				15
PHILIPPINES	20A	20									20	
PUERTO RICO	20	20		40	40	40	40	40				15
SOUTH AFRICA	20	20								15	15	15
U.S.S.R.									20	20	20	20
EAST COAST	15	20	40	40	40	40	20	20A	15	15	15	15

A=Next higher frequency may also be used.

### FEBRUARY 1994

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G-F	2 G-F	3 G-F	4 G-F	5 F
6 F-P	7 P	8 P	9 P	10 F-G	11 G-F	12 F-P
13 P	14 P-F	15 F	16 F-G	17 G	18 G	19 G-F
20 F-P	21 P	22 P-F	23 F-G	24 G	25 G-F	26 F
27 F-G	28 G					

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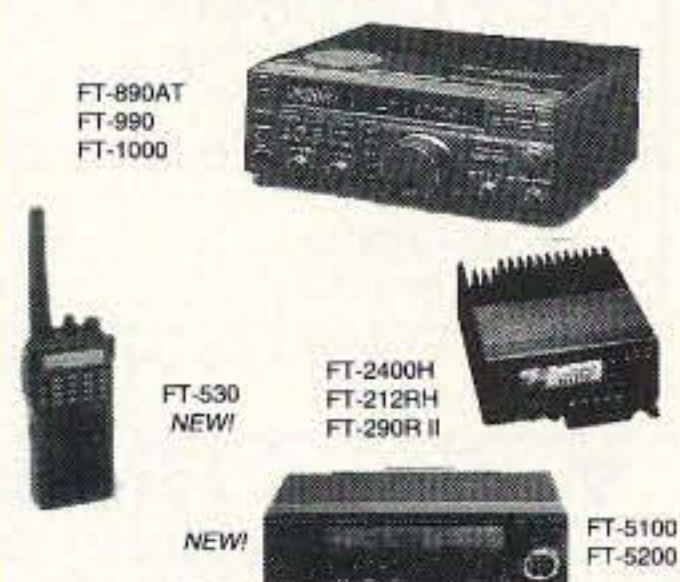
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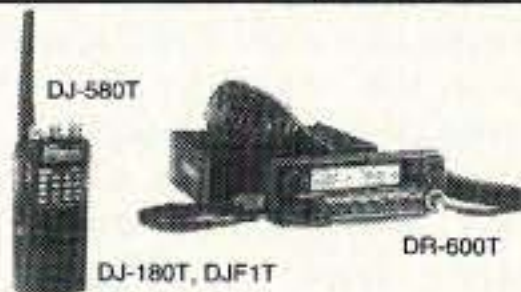
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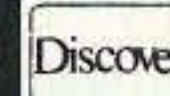
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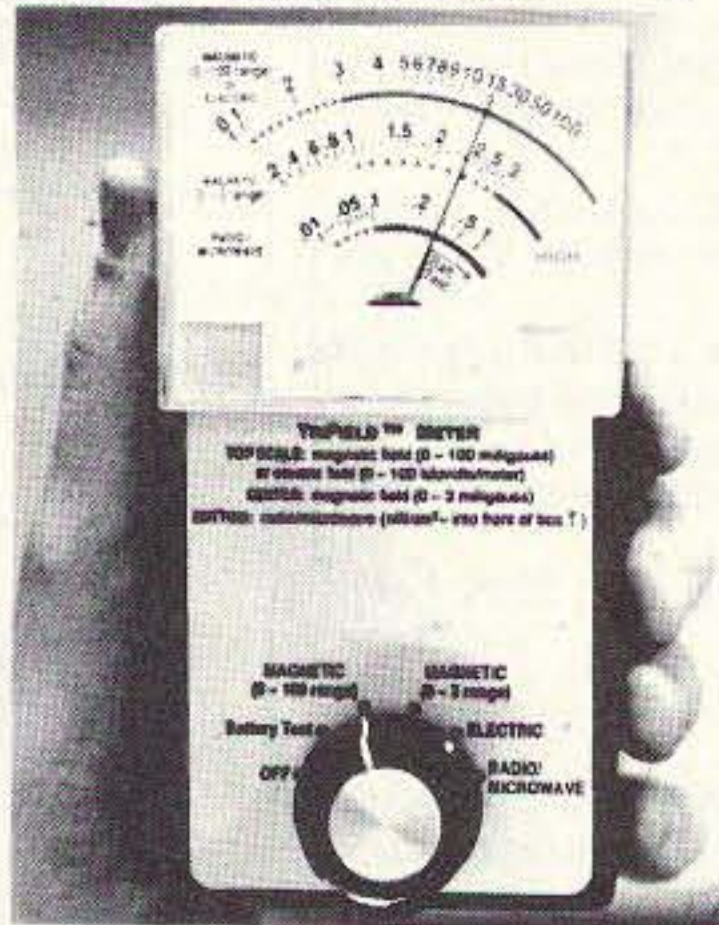
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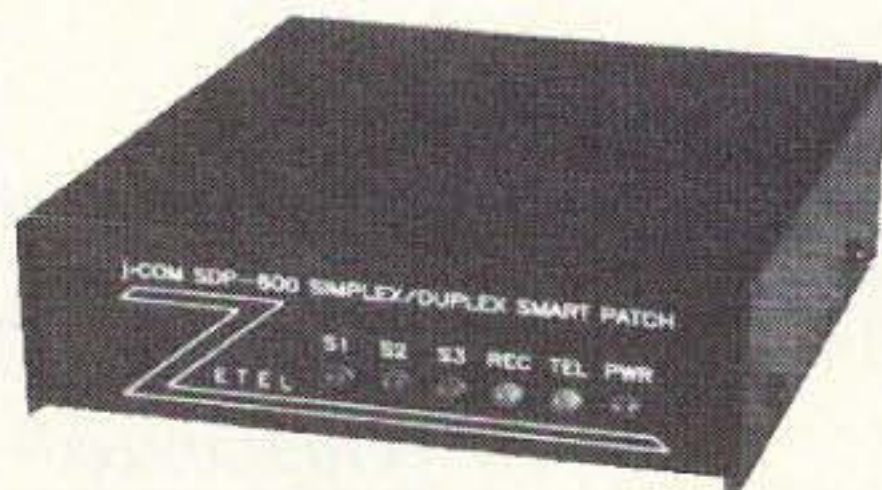
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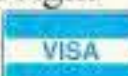
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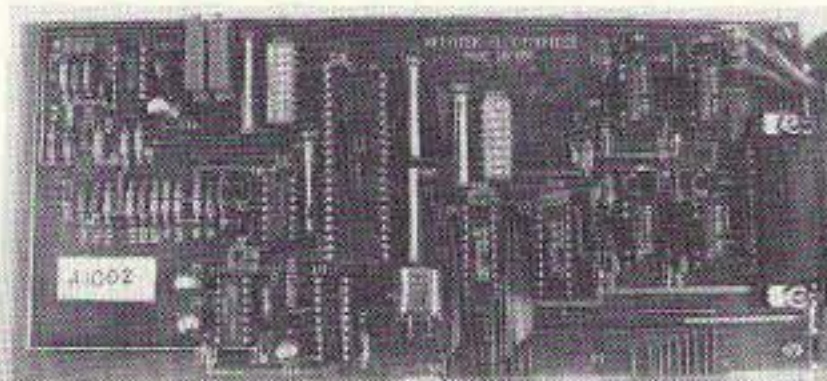
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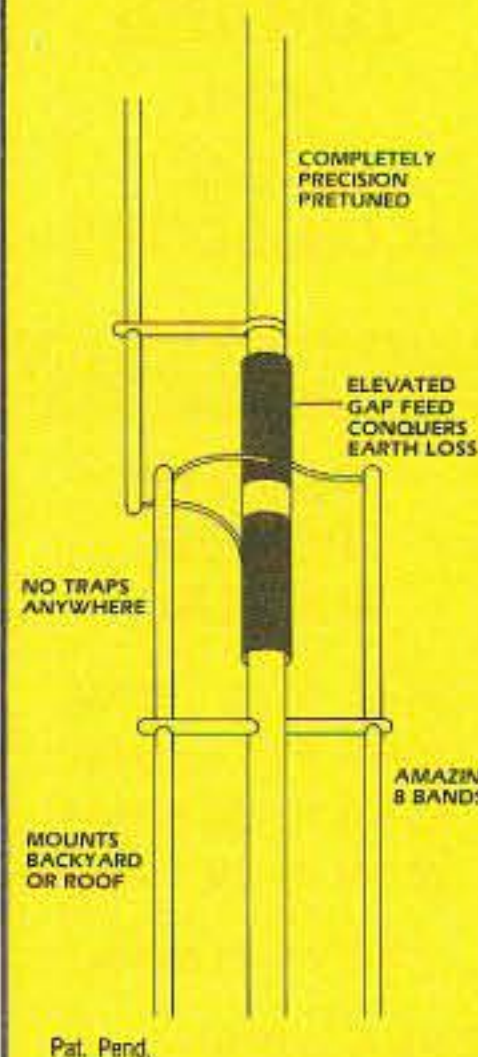
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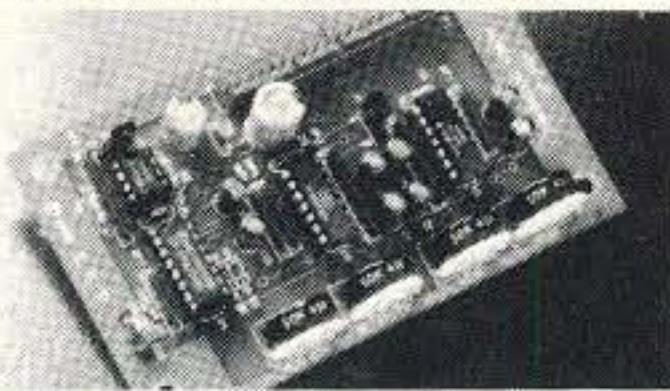
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## Enough!

Polly Klaas was a beautiful 12-year-old girl. Last year, on October 1, she was having a slumber party with a few of her friends. Her mother slept downstairs while the girls stayed up and discussed things of monumental importance to 12-year-old girls. A knife-wielding thug broke into the house, tied up the girls, took Polly and left.

Despite a monumental publicity and search effort by the citizens of Polly's home town, this beautiful little girl's body was found two months later. The man who murdered her had been confronted by police twice during those two months, the first being less than two hours after the kidnapping. He has a record of arrests and convictions for abductions and other violent crimes going back almost 20 years. He has served time in prison for these crimes, and yet he was free to walk the streets of California just like you and me.

In the last two weeks, authorities in St. Louis have had to inform two sets of parents that their children won't be coming home—ever. They were both little girls. One was 9 and the other was 10.

If you live in a small, rural community, and you think this kind of heinous crime can't happen to you—think again. Ten days after Polly Klaas disappeared, Stephanie Crane was abducted from her small Idaho town—population 700.

Are you mad yet? Have you had enough of this? Are you going to continue to allow the scum of our society to get away with this? Are you going to continue to elect local, state and federal politicians who are afraid to make the hard choices of taking away the rights of convicted criminals in order to protect the rights and lives of the law-abiding? How many more beautiful 12-year-old girls are going to have to die horrible and lonely deaths before the people of America wake up and demand a criminal justice system that deals with crime and the punishing of criminals? Over 500 children were abducted last year, and that's 500 more than we should tolerate. Today, as you read this, another child is being taken—another child that we'll never find. I gotta' tell ya' folks, I am beside myself with anger over this. I can barely type these words. I have had enough.

## Amateur Radio Can Be Part of the Solution

The common response to this type of situation is: "What can I possibly do?" Aside from electing people carefully and supporting spending for more cops, bigger prisons, longer sentences and abolishing the parole

system, what *can* the average person do?

We may not feel like we have control over courts, prisons and parole boards, but we *can* do something. We can say enough is enough. We can say that the next time a child turns up missing we will be prepared. Not prepared to help tomorrow or next week—we can be prepared to help *right now*.

When a small plane crashes (or is only *thought* to have crashed), there are systems and volunteer organizations in place to search for and come to the aid of the crash victims. As a Private Pilot I am thankful to always know that should the unthinkable happen, I won't be left to die on the craggy slopes of a windswept New Hampshire mountain because there wasn't a system in place to come find me. Within hours of my late arrival there will be dozens of people and aircraft searching for me.

## "Over 500 children were abducted last year, and that's 500 more than we should tolerate."

Couldn't we do the same for the children of America, and isn't the amateur radio community ideally suited to form the core of such a system?

Even with the best efforts of law enforcement, it can be several hours between the time a parent reports a missing child and when any kind of an organized search begins. Think about it. It's six o'clock. You just got home from work, and your 12-year-old isn't there. He was supposed to be home after school, by three o'clock at the latest. You call your neighbors, and they haven't seen him. You call his school friends, but none of them know where he is. You call the police, and they send someone out to your house to ask some questions, while alerting their patrol officers of a *possible* missing child. You provide police with a description and a picture. While talking with the police officer, you remember the name of another of your child's friends. You call and he tells you that he saw your son get into a blue car driven by a tall man with a beard. This information is immediately transmitted to local law enforcement. What time is it now? How long has your child been missing? How far away could the kidnapper have traveled in that amount of time?

Over the next few days, volunteer search teams are set up. Posters are distributed over an ever-widening area. The FBI gets involved, as do several of the national organizations

set up to assist in finding children. How many days go by? How many nights? Will you ever see your child again?

What would have happened to Polly Klaas if, within an hour of the local police department's call to an amateur radio search coordinator, there were several dozen *trained* hams searching in an ever-widening pattern, all coordinated with a net control station at the police department? What if another dozen teams were searching in automobiles, checking all available modes of escape out of the area, driving the roads and stopping at stores and gas stations and asking questions? What if the eyewitness's description of the kidnapper was transmitted via packet to the local search teams in surrounding communities or neighboring states, not days but minutes after it was available? What if all of this happened within one hour of the initial call to local police?

It doesn't matter if the child is *really* missing, or if he just went somewhere without telling his parents. Every second of doubt is an eternity of anguish for parents who don't know where their child is. How would you feel if you were the ham who could

transmit to net control, "I found him. He's OK."?

I'm not talking about a bunch of fat guys with HTs on their belts and a Rambo complex. I'm talking about an organization that sets up systems with the aid and backing of local and national law enforcement agencies *before* they are needed. I'm talking about a national organization, with state and local chapters, that continuously trains and prepares for the day when they have to—within 60 minutes—mobilize to search for a missing child with the same thoroughness of the Civil Air Patrol's search for a missing pilot.

## Amateur Radio Child Search

I propose the founding of an organization called Amateur Radio Child Search (ARCS). To assist in getting this started, Wayne Green has pledged the financial and logistical support of 73 and the entire Wayne Green, Incorporated organization. I am looking for amateur radio operators in all 50 states to assist in developing this organization. I will listen to anyone and everyone who is willing to help (I'm not saying that I'll take your advice, just that I'll listen to it). I mean it. I would welcome the participation of the ARRL or any other amateur radio company or group. This is above the petty squabbles of amateur radio (and amateur radio magazines). This is above your animosity towards Wayne Green, me or

73 magazine. I am looking for funding avenues to aid in forming this national organization. If you have experience in areas such as grant writing, your help would be most welcome. If you are already involved in search and rescue, whether professionally or as a volunteer, I'd like to hear from you.

The plan is to have local groups in every state, all coordinated by a national organization, to assist law enforcement in the immediate search for missing children. If you're a paramilitary, soldier of fortune, cop wanna-be type of nut, please do me a favor and stay away. We're not talking about chasing bad guys. All we want to do is find missing kids.

The state coordinators, all selected by the national office, will oversee the operation and training of their local team leaders. Team leaders, selected by state coordinators with the approval of the national office, will be responsible for the training of their local chapter, as well as building and maintaining relationships with local law enforcement agencies. Chapter members will be responsible for staying current in their training and being available to assist in the search for a missing child *within one hour* of notification. Everyone involved in this organization will be screened and registered by the national office.

Amateur radio desperately needs to justify its existence. We no longer advance the state of the art, we are not needed as a trained pool of qualified radio operators, and there ain't a whole helluva lot of international goodwill generated by the average DX contact. How about if we decided that one of the reasons for our existence should be to use our communications skills and networks to come to the aid of missing children? There are well over 250,000 *active* amateur radio operators in this country. Could the combined efforts of a quarter million people, united for the single purpose of protecting the lives of our children, make a difference? Is there any more important use of our time and talents?

I may be setting myself up for a big disappointment by announcing this before the logistics are worked out, but if there is one thing I have learned from Wayne Green in the last four years it's that the only way to get something done is to just do it. Talking about it doesn't get it done. It will take several months to find out if starting an organization such as I've described is even possible. I'll be meeting with attorneys and accountants to set up the paperwork. I need the help of every interested person. If nothing else, send me your name, address and phone number so I can put you on the list for when your state and local chapter gets started. If you can do more, let me know that too.

Inquiries should be sent to my attention at 73 *Amateur Radio Today*, 70 Route 202 N, Peterborough, NH 03458.

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Wide Receiver Coverage:  
FT-11: 110-180 MHz RX,  
144-148 MHz TX  
FT-41: 430-450 MHz RX/TX
  - Selectable Alpha Numeric Display
  - New Compact Battery Design  
4.8V produces 1.5 Watts  
9.6V produces Full 5 Watts
  - 150 Memory Channels  
(75 when Alpha Numeric)
  - AM "Aircraft" Receive  
(110-136 MHz)
  - Small Compact Size w/ Easy  
Operation (measures only:  
4"H x 2 1/4"W x 1"D)
  - Rx/Tx Battery Savers
  - High-efficiency MOS FET Power  
Module
  - Large Back-Lit Keypad and  
Display
  - Up/Down Volume/Squelch  
Controls
  - Built-in DTMF Paging/Coded  
Squelch
  - Automatic Power Off (APO)
  - **Accessories:**  
FNB-31 4.8V, 600 mAh Battery  
FNB-33 4.8V, 1200 mAh Battery  
FNB-38 9.6V, 600 mAh Battery  
FBA-14 6 AA Size Battery Case  
FTS-26 CTCSS Decode Unit  
NC-50 Dual Slot 1-Hour Desk  
Charger  
CA-10 Charge Adapter  
(required w/ NC-50)
- Contact your Dealer  
for full details.

"Look, alphanumeric display and a 4.8V battery. Terrific!"

"Small and thin – with a full sized keypad! How'd they do that?"

"Yaesu did it again!"

**NEW!**



### NEW Alphanumeric Display

First time for Yaesu HT Full function LCD combines letters and numbers.

**NEW Up/Down Thumb Control** with Volume and Squelch Bar Graph. No other radio has this. Back lit, too!

**NEW Compact Battery Design** 4.8V gets you 1.5 Watts. A first for amateur radio.

# Get a grip on this!

World's smallest size HT with a full sized keypad  
Measures only: 4"H x 2 1/4"W x 1"D

"Small" is relative, isn't it? It could mean size – which in this case it does. And, it could mean "reduced", which it doesn't! Nothing missing from the hot new FT-11R HT from Yaesu except bulk! You're going to wonder just how all the features of this full-function radio fit in. Until you remember Yaesu pioneered 2-way radio micro technology.

To see what this really means to you,

check out all the new features. Like the alphanumeric display. This Yaesu HT first, lets you tag your favorite frequency by name, call sign or number. Or, the new "voltage stingy" battery. It's an industry first for amateur radio. Smaller and compact, the 4.8V battery gives you 1.5 watts on TX. And, if that's not enough, there's an optional drop in, dash mount battery charger.

You see it's not a small time performer. Just small sized. The FT-11R. Another small example of Yaesu superiority. See your dealer today!

**YAESU**  
Performance without compromise.<sup>SM</sup>

# KENWOOD

...pacesetter in Amateur Radio

To get the most out of handheld communications, choose Kenwood's TH-78A (144MHz/440MHz) which offers all the latest features. Or the TH-28A (144MHz) and TH-48A (440MHz) single-band transceivers, which are equally impressive. All three represent a winning combination of top-flight technology and ergonomic design.

# Handful of Performance

Dynamic performance plus handheld convenience—from Kenwood

- **Alphanumeric memory**  
Alphanumeric data (max. 6 characters) can be entered directly into memory.
- **Alphanumeric message paging**  
In addition to standard DTSS and paging functions, alphanumeric messages can be stored in memory for immediate transmission.
- **Dual-frequency receive**  
In addition to full-duplex cross-band operation, the TH-78A is equipped to receive two frequencies simultaneously, even on the same band. There's also independent double-band scan and ABC (automatic band change). The TH-28A and TH-48A feature dual-band receive capability, enabling semi-duplex cross-band operations (TH-28→TH-48A).
- **Frequency coverage**  
TH-28A: 118-173.995 MHz, sub RX: 438-449.995 MHz; TH-48A: 438-449.995 MHz, sub RX: 136-173.995 MHz; TH-78A: 118-173.995, 438-449.995 MHz. Transmit on Amateur bands only. (MARS/CAP modifiable, permits required).
- **2.5W power with supplied battery pack**  
5W with 12 VDC power source (PB-14, PB-17, or external DC).
- **Non-volatile memory**  
The TH-78A has 50 memory channels (expandable to 250 with the ME-1 option), while the TH-28A and TH-48A have 40 channels (expandable to 240 with the ME-1 option).



## TH-78A/28A/48A

FM Handheld Transceivers

KENWOOD COMMUNICATIONS CORPORATION  
AMATEUR RADIO PRODUCTS GROUP  
P.O. BOX 22745, 2201 E. Dominguez Street  
Long Beach, CA 90801-5745

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